TM 11-2446

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

WIND MEASURING SET AN/GMQ-12

DEPARTMENT OF THE ARMY • *MAY 1957*

WARNING

HIGH VOLTAGE

is used in this
equipment

DEATH ON CONTACT

may result
if safety precautions
are not observed

Be careful not to contact high-voltage connections or any power connections when using this equipment. Turn off the power and discharge all high-voltage capacitors before making any test connections or doing any work inside the equipment.

DON'T TAKE CHANCES

TECHNICAL MANUAL
No. 11–2446

DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *8 May 1957*

WIND MEASURING SET AN/GMQ–12

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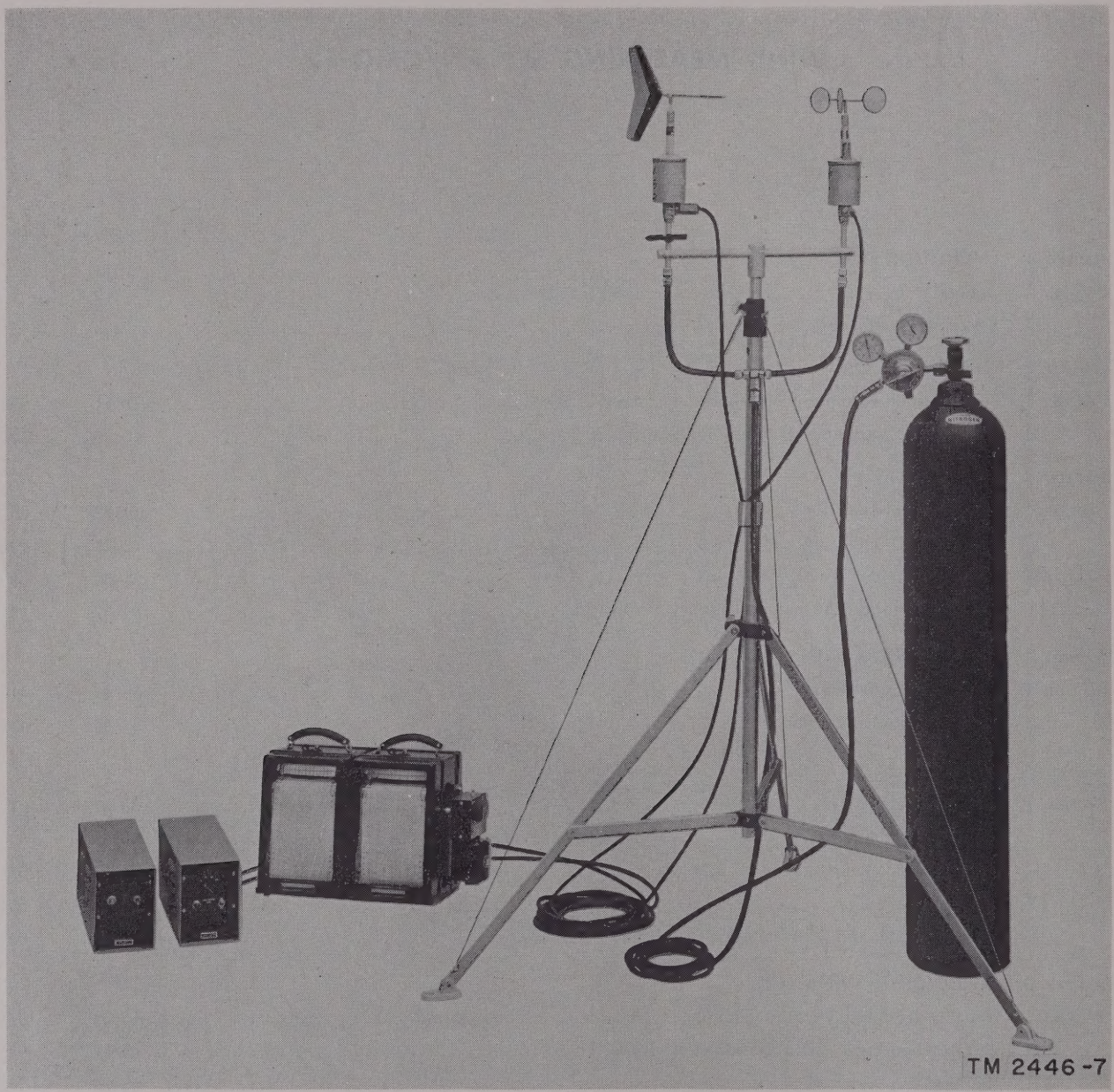

Figure 1. Wind Measuring Set AN/GMQ–12 major components and nitrogen tank.

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

a. This manual contains information on the installation, operation, and organizational and field maintenance of Wind Measuring Set AN/GMQ–12.

b. Forward comments on this manual directly to Commanding Officer, U. S. Army Signal Publications Agency, Fort Monmouth, N. J.

2. Forms and Records

a. Unsatisfactory Equipment Report. Fill out and forward DA Form 468 (Unsatisfactory Equipment Report) to Commanding Officer, U. S. Army Signal Equipment Support Agency, Fort Monmouth, New Jersey, as prescribed in AR 700–38.

b. Damaged or Improper Shipment. Fill out and forward DD Form 6, (Report of Damaged or Improper Shipment) as prescribed in AR 700–58 (Army); Navy Shipping Guide, Article 1850–4 (Navy); and AFR 71–4 (Air Force).

Section II. DESCRIPTION AND DATA

3. Purpose and Use

Wind Measuring Set AN/GMQ–12 (fig. 1) measures and records the speed and the direction of low level winds. The functions of the major components are outlined in *a* through *f* below.

a. Wind Direction Detector T–628/GMQ–12 (fig. 2) develops and electrically transmits wind direction values to Amplifier-Power Supply AM–1618/GMQ–12.

b. Wind Speed Detector T–627/GMQ–12 dedevelops and electrically transmits wind speed values to Amplifier-Power Supply AM–1618/GMQ–12.

c. Amplifier-Power Supply AM–1618/GMQ–12 amplifies and changes the electrical signals received from Wind Speed Detector T–627/GMQ–12 and Wind Direction Detector T–628/GMQ–12 into electrical values for operating Wind Direction and Wind Speed Recorder RO–64/GMQ–12.

d. Wind Direction and Wind Speed Recorder RO–64/GMQ–12 graphically records the information transmitted by Amplifier-Power Supply AM–1618/GMQ–12.

e. Vibrator-Inverter PP–1689/GMQ–12 changes 6 volts direct current (dc) to 117 volts alternating current (ac) for operating Amplifier-Power Supply AM–1618/GMQ–12 when ac power is not available.

f. Meteorological Tripod MT–1825/GMQ–12 supports Wind Speed Detector T–627/GMQ–12 and Wind Direction Detector T–628/GMQ–12.

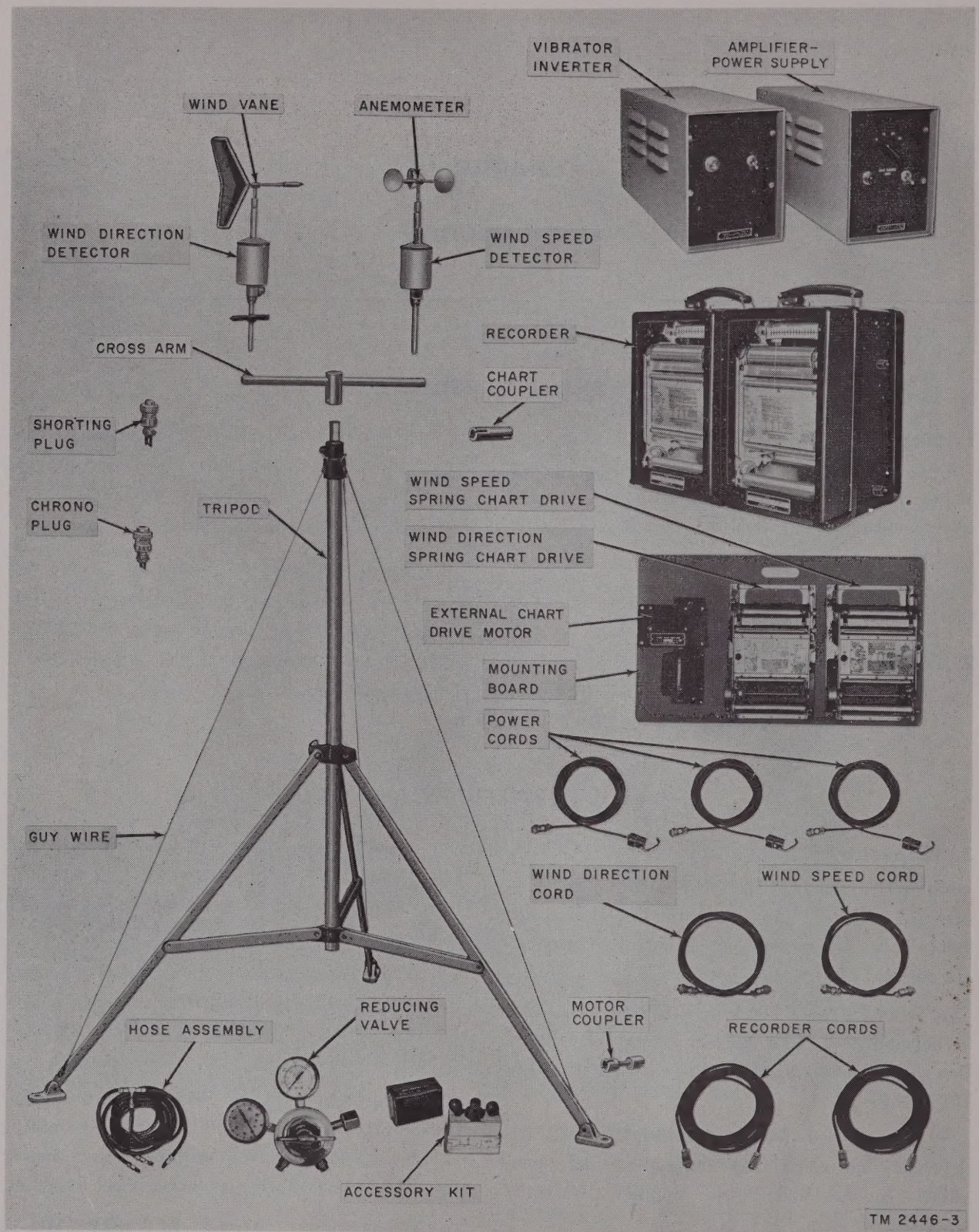

Figure 2. Wind Measuring Set AN/GMQ–12, major components (less chart rolls and carrying cases).

4. Components of Wind Measuring Set AN/GMQ–12

(figs. 2 and 3)

Component	Quantity	Dimensions (in.)			Volume (cu ft)	Weight (lb)
		Height	Depth	Width		
Wind Speed Detector T–627/GMQ–12	1	15	3	.....	.0027 (less anemometer).	1¼
Wind Direction Detector T–628/GMQ–12.	1	15	3	.....	.0032 (less wind vane).	1¼
Amplifier-Power Supply AM–1618/GMQ–12.	1	7⅜	5⅛	16½	.361	20
Vibrator-Inverter PP–1689/GMQ–12.	1	7⅜	5⅛	16½	.361	25
Wind Direction and Wind Speed Recorder RO–64/GMQ–12, including:	1	13¼	9¼	17½	1.24	50
Wind speed synchronous chart drive with three sets of change gears.	1	12	4½	8	.17	8
Wind speed spring chart drive with three sets of change gears and a crank.	1	12	4½	8	.17	8
Wind direction synchronous chart drive with three sets of change gears.	1	12	4½	8	.17	6½
Wind direction spring chart drive with three sets of change gears and a crank.	1	12	4½	8	.17	6½
Chart coupler	1					
Motor coupler	1					
External chart drive motor	1	6½	3½	9½	.046	6
Accessory kit consisting of:	.....	4¼	1⅞	4½	.021	.5
Eyedropper for inkwell filler	1					
Inkwell filler	1					
Metal pen point	1					
Meteorological Tripod MT–1825/GMQ–12.	1	106	7½	57½	.....	26¼
Power cord (with adapter connectors).	3	.....	.....	180	.....	2½
Power cord (external chart drive motor).	1					
Wind direction cord	1	.....	.....	25 (lg)	.....	6
Wind speed cord	1	.....	.....	25 (lg)	.....	6
Recorder cord	2	.....	.....	10 (lg)	.....	2½
Shorting plug	1	.....	1	2	.....	.3
Chrono plug	1	.....	1	2	.....	.3
Hose assembly	1	.....	.....	22 (lg)	.....	2½
Reducing valve	1	7	7	9	.....	6½
Carrying case No. 1	1	8¼	11	55¼	2.90	30
Carrying case No. 2	1	10	12¾	20	1.48	17
Carrying case No. 3	1	13¾	21	25¼	4.23	41
Carrying case No. 4	1	17¼	21	29½	6.20	53
Wind direction chart rolls	100	2½	2½	4¼	.....	6
Wind speed chart rolls	100	2½	2½	4¼	.....	6
Running spares (par. 6)	1 set					
Total weight						328

5. Description of Components

a. Wind Direction Detector T–628/GMQ–12 (fig. 2). Wind Direction Detector T–628/GMQ–12 has a wind vane on the detector housing. A tabular rod in the bottom of the detector housing mounts in the crossarm of the tripod. A sighting bar is on the side of the tubular rod for positioning the wind direction detector during installation.

b. Wind Speed Detector T–627/GMQ–12. The wind speed detector has a three-cup anemometer on the detector housing. A tubular rod, fastened to the bottom of the detector housing, mounts in the crossarm of the tripod.

c. Amplifier-Power Supply AM–1618/GMQ–12. The amplifier-power supply contains an ON-OFF switch, indicator lamp, and a MAX. RANGE MPH

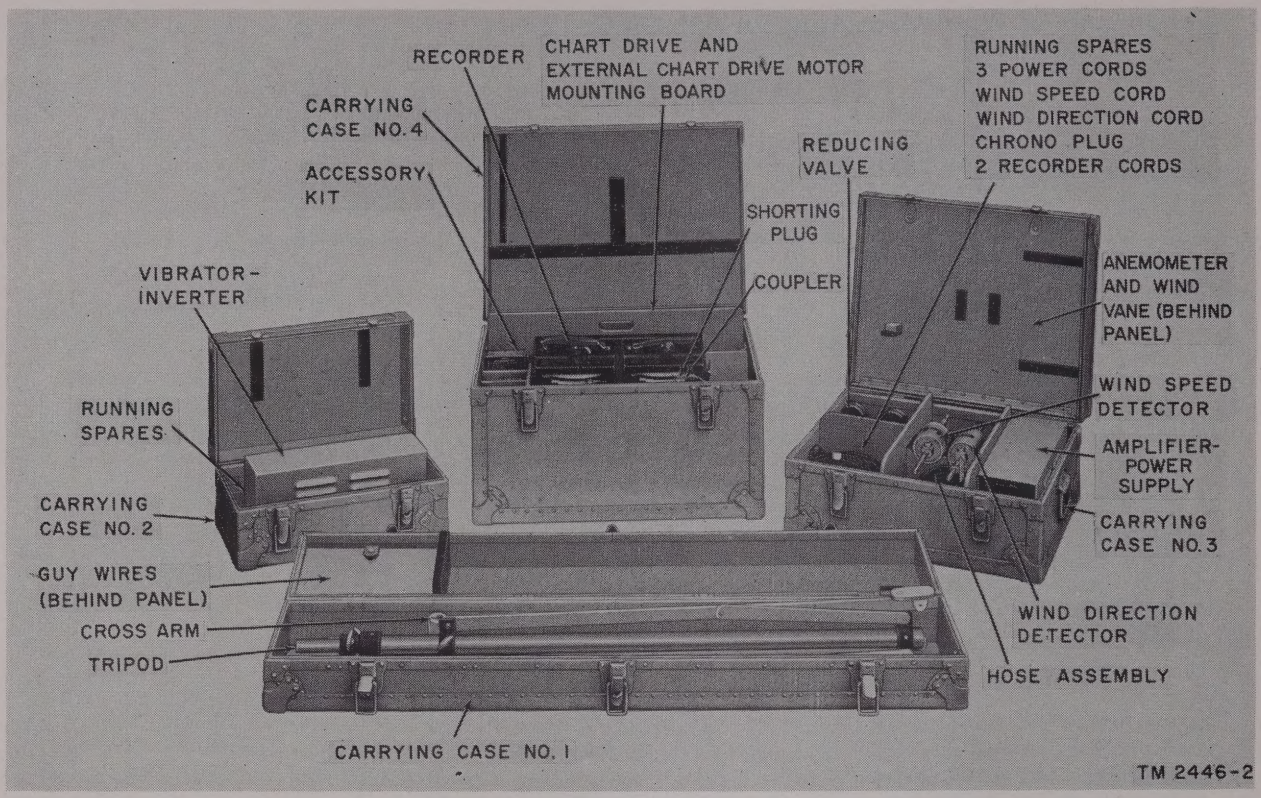

Figure 3. Wind Measuring Set AN/GMQ–12 (less chart rolls), packed in its carrying cases.

switch. The rear panel contains a selector switch, a line fuse, a spare fuse, and six connectors (fig. 12).

d. Wind Direction and Wind Speed Recorder RO–64/GMQ–12. The recorder (fig. 2) consists of a wind speed and a wind direction recorder on a common chassis, an external chart drive motor, an accessory kit, and synchronous and spring chart drives. The chart drives that are not in use are on a mounting board in the carrying case. Three sets of speed change gears are included in each chart drive (fig. 21) one set of gears (change gears) are installed for operation, and two sets of gears (accessory speed change gears) are clipped to the side of the chart drives for storage. A crank for winding the spring chart motors is attached to each spring chart drive.

e. Vibrator - Inverter PP–1689/GMQ–12. The vibrator-inverter front panel has an ON-OFF switch and an indicator lamp. The rear panel (fig. 13) has a three terminal receptacle, two binding posts, a 25-ampere fuse, and a spare fuse.

f. Meteorological Tripod MT–1825/GMQ–12. The tripod (figs. 2 and 8) consists of an adjustable height shaft, three guy wires for stablizing the tripod in high winds, and a crossarm for mounting the wind speed and wind direction detectors.

g. Reducing Valve. The reducing valve is used with a standard tank of compressed nitrogen. The netrogen keeps the wind speed and direction detectors free from dirt and moisture. The reducing valve (fig. 10) has a tank pressure gage for indicating the pressure in the nitrogen tank and an output pressure gage for indicating the pressure being applied to Wind Speed Detector T–627/GMQ–12 and Wind Direction Detector T–628/GMQ–12.

6. Running Spares

(fig. 4)

The running spares supplied with Wind Measuring Set AN/GMQ–12 are as follows:

1 tube 5726
1 tube 6627
1 tube 5965
1 tube 6087
1 tube 5751
1 phototube 170–590–74
1 pilot lamp, No. 44
1 pilot lamp, type NE 51

2 exciter lamps, 170–590–75
6 fuses, 2-ampere, type 2AG
6 fuses, 25-ampere, type 3AG

7. Technical Characteristics

Wind Measuring Set AN/GMQ–12 (overall):

Power requirements .....110 to 125 volts ac, 60 cycles, 2-amp, or 6 volts dc, 25 amp.

Range:

Wind speed .....5 to 6, .5 to 12, .5 to 30, and .5 to 60 mph.

Wind direction .....Records to 354° minimum. Mechanical rotation 360°.

Accuracy:

Wind speed .....±4% at full scale.

Wind direction .....±3% at full scale.

Sensitivity:

Wind speed .....1 to 60 mph ±4%.

Wind direction .....344.38° (minimum).

Number of tubes.....8.

Wind Speed Detector T–627/GMQ–12:

Voltage requirements .....195 volts dc, 12.6 volts ac, and 5.5 volts dc.

Range .....1 to 60 mph ±1%.

Accuracy .....Relationship between wind speed and rate of revolution linear within ±1%.

Sensitivity .....Less than 1 mph.

Number of tubes.....2.

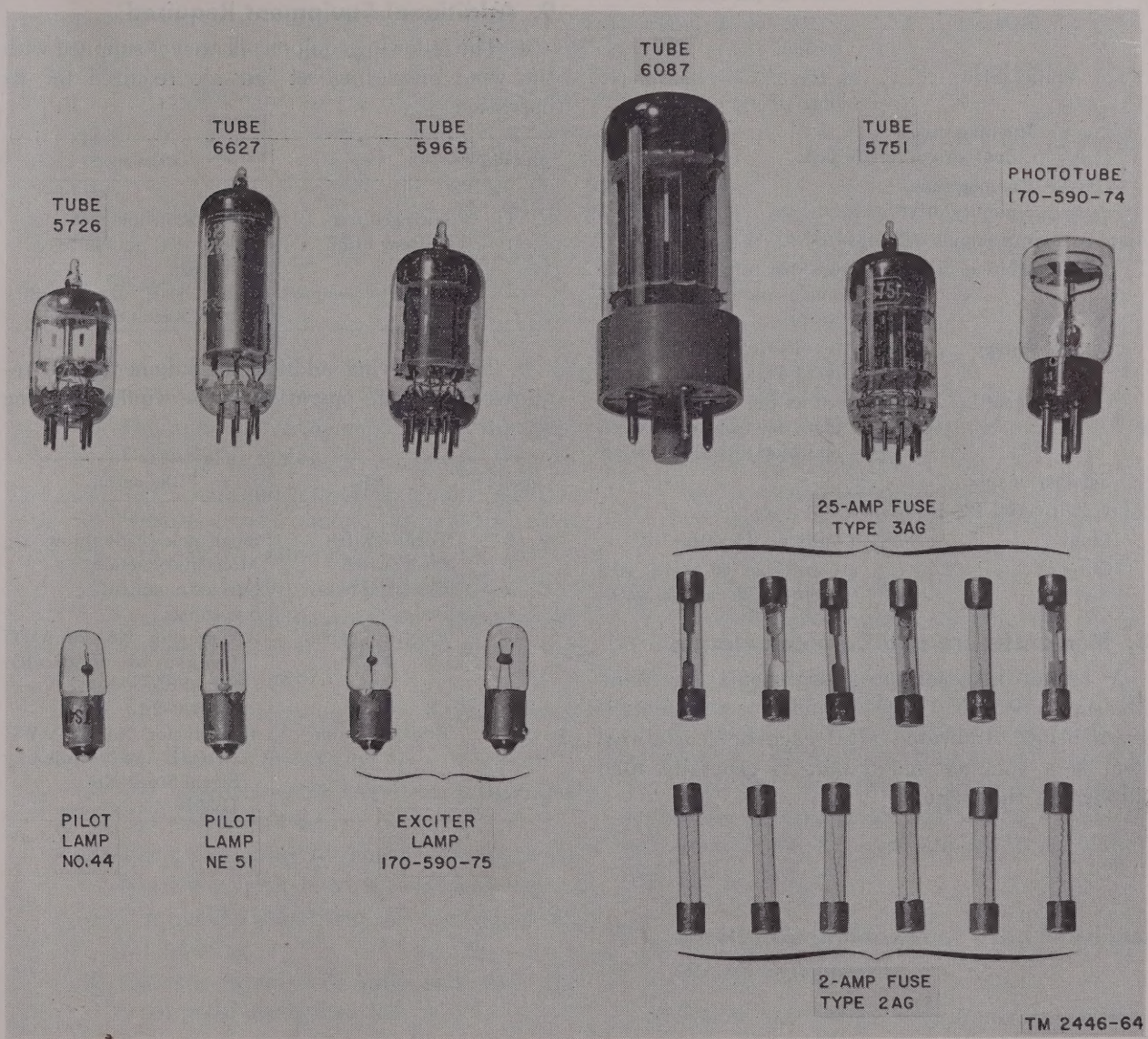

Figure 4. Running spares.

Wind Direction Detector T–628/GMQ–12:

Voltage requirements ....108 volts, regulated dc.

Range .....354° ±1%.

Accuracy .....1 to 60 mph ±1%.

Sensitivity .....Less than 1 mph.

Wind Direction and Speed Recorder RO–64/GMQ–12:

Voltage requirements ....115 volts ac, for synchronous chart drive.

Range:

Wind speed .....0.5 to 60 mph.

Wind direction .....360° rotation.

Accuracy .....±1%.

Chart speeds:

Synchronous (electrical):

Internal .....¾, 1½, 3, 6, or 12 inches per hour or per minute.

External .....¾, 1½, or 3 inches per second.

Spring drive .....¾, 1½, 3, 6, or 12 inches per hour or per minute.

Running time, hour drive.....8 days.

Running time, minute drive....3½ hours.

Amplifier-Power Supply AM–1618/GMQ–12:

Power requirements .....110 to 125 volts ac, 60 cycles, single phase, 2 amp, 45 watts.

Output voltage .....215 volts dc, 108 volts, regulated dc, and 12.6 volts ac.

Output signal .....1,000 ua full scale into 1,400 ohms for each wind speed and wind direction circuits.

Number of tubes.....6.

Vibrator-Inverter PP–1689/GMQ–12:

Input .....6 volts dc, 15 amp.

Output .....117 volts ac, 60 cycles (±2 cycles), .425 amp, 50 watts.

8. Nomenclature and Common Names

A list of nomenclature assignments for Wind Measuring Set AN/GMQ–12 and its components is given below. Indicated after each nomenclatured item is a common name that is generally used throughout the manual.

Nomenclature	Common name
Wind Measuring Set AN/GMQ–12	Wind measuring set
Wind Speed Detector T–627/GMQ–12	Wind speed detector
Wind Direction Detector T–628/GMQ–12.	Wind direction detector
Amplifier-Power Supply AM–1618/GMQ–12.	Amplifier-power supply
Wind Direction and Speed Recorder RO–64/GMQ–12.	Recorder
Vibrator-Inverter PP–1689/GMQ–12.	Vibrator-inverter
Meteorological Tripod MT–1825/GMQ–12.	Tripod

9. Additional Equipment Required

a. The following equipments are *not* supplied with the wind measuring set but are required for its operation.

Quantity	Item	Description
1	Nitrogen tank	200 to 225 cubic feet
1	Battery 3B57	6 volt, wet, automotive storage.
1	Magnetic compass	Hand held, dry, forestry type, 3 inch diameter.

b. The following additional equipments are required for remote operation of the wind measuring set.

Quantity	Item	Description
2	Toggle switch	Single pole single throw
1	Push switch	Momentary action
1	Electrical box	Surface mounted
1	Plate	3 openings
1	Electrical cable	2 conductor No. 20 AWG (length as required). Signal Stock No. 1B3020–2.13.
1	Electrical cable	4 conductor No. 20 AWG (length as required). Signal Stock No. IB3020–4.3.

CHAPTER 2

INSTALLATION

Section I. SERVICE UPON RECEIPT OF EQUIPMENT

10. Uncrating, Unpacking, and Checking

(figs. 3, 5, 6, and 7)

a. Packaging Data. The equipment is packagedas follows:

Crate	Dimensions (in.)			Volume (cu. ft.)	Weight (lb.)	Contents of crate
	Height	Width	Depth			
1 of 5	10¼	12¾	59½	4.57	37	Carrying case No. 1 and contents (fig. 3)
2 of 5	11¾	14½	24½	2.42	55	Carrying case No. 2 and contents
3 of 5	15¾	22¾	28¾	5.97	65	Carrying case No. 3 and contents
4 of 5	21½	25	39	12.13	80	Carrying case No. 4 and contents
5 of 5	15¾	25	28	6.3	25	Chart rolls (fig. 7)
Total weight					262	

b. Unpacking Crates Nos. 1, 2, and 3 (fig. 5).

(1) Cut and remove the metal straps that bind the wooden crate.

(2) Use a nail puller to remove nails from the wooden cover; remove the wooden cover.

(3) Lift out the waterproof corrugated box.

(4) Cut the waterproof tape and open the waterproof corrugated box. Remove the technical manuals from the sealed bag (crate No. 1 only).

(5) Lift out the carrying case and the padding.

c. Unpacking Crate No. 4 (fig. 6).

(1) Cut and remove the metal straps that bind the wooden crate.

(2) Use a nail puller to remove nails from the wooden cover; remove the wooden cover.

(3) Lift out the waterproof corrugated box and the padding.

(4) Cut the waterproof tape and open the waterproof corrugated box.

(5) Open the inner corrugated box and lift out the carrying case and padding.

d. Unpacking Crate No. 5 (fig. 7).

(1) Cut and remove the metal straps that bind the wooden crate.

(2) Use a nail puller to remove nails from the wooden cover; remove the wooden cover.

(3) Lift out the waterproof corrugated box.

(4) Cut the waterproof tape and open the waterproof corrugated box and the case liner.

(5) Remove chart rolls as required.

e. Checking. Check the equipment against the packing list. Where no packing list is included with the equipment, the table of components (par. 4) and/or the packaging data (*a* above) may be used as a general check to indicate the equipment that has been packed.

11. Service Upon Receipt of Used or Reconditioned Equipment

a. Follow the instructions in paragraph 10 for uncrating, unpacking, and checking the AN/GMQ–12.

b. Check the used or reconditioned equipment for tags or other indications pertaining to changes in the wiring of the equipment. If any changes have been made in wiring, note the changes on the schematic diagrams (figs. 65 and 66) and the wiring diagrams (figs. 67–71).

c. Perform the installation and connection procedures given in paragraphs 12 through 20.

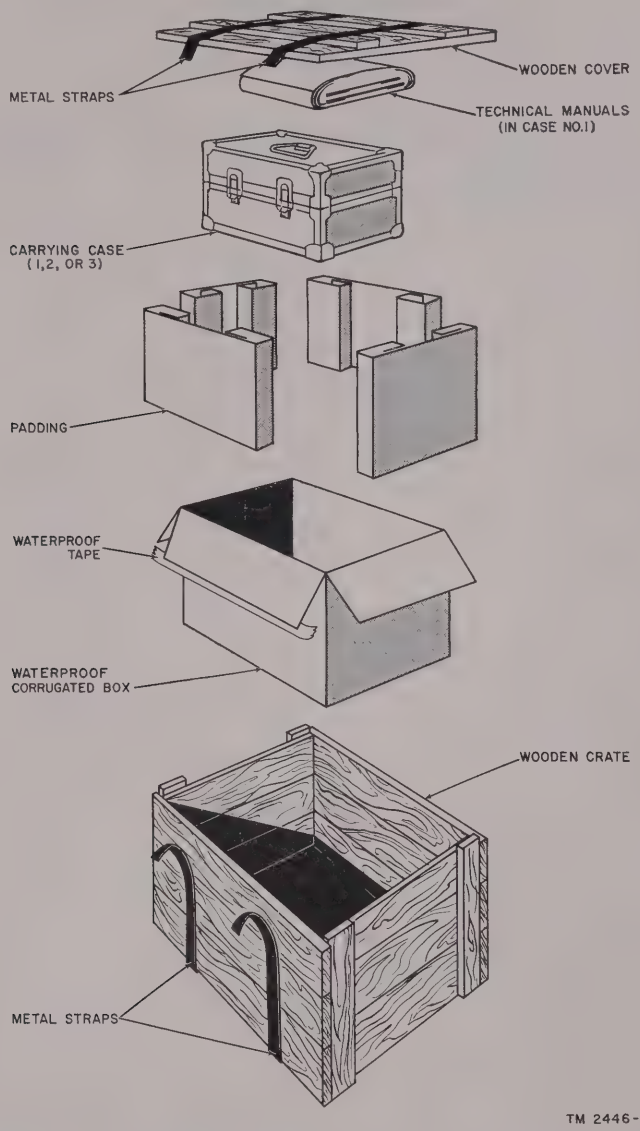

Figure 5. Amplifier-power supply, vibrator-inverter, or tripod packing and packaging diagrams.

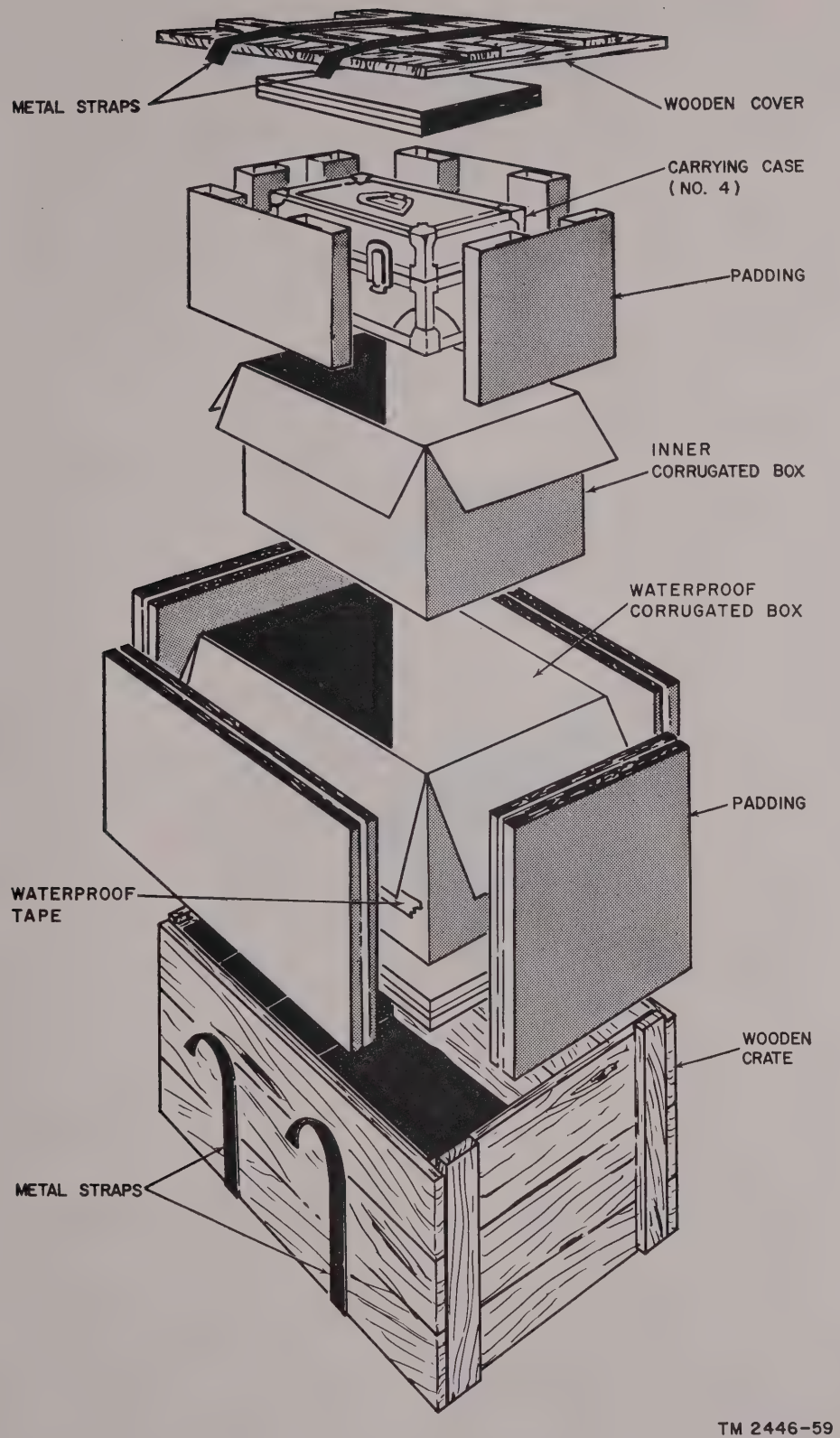

Figure 6. Recorder, packing and packaging diagram.

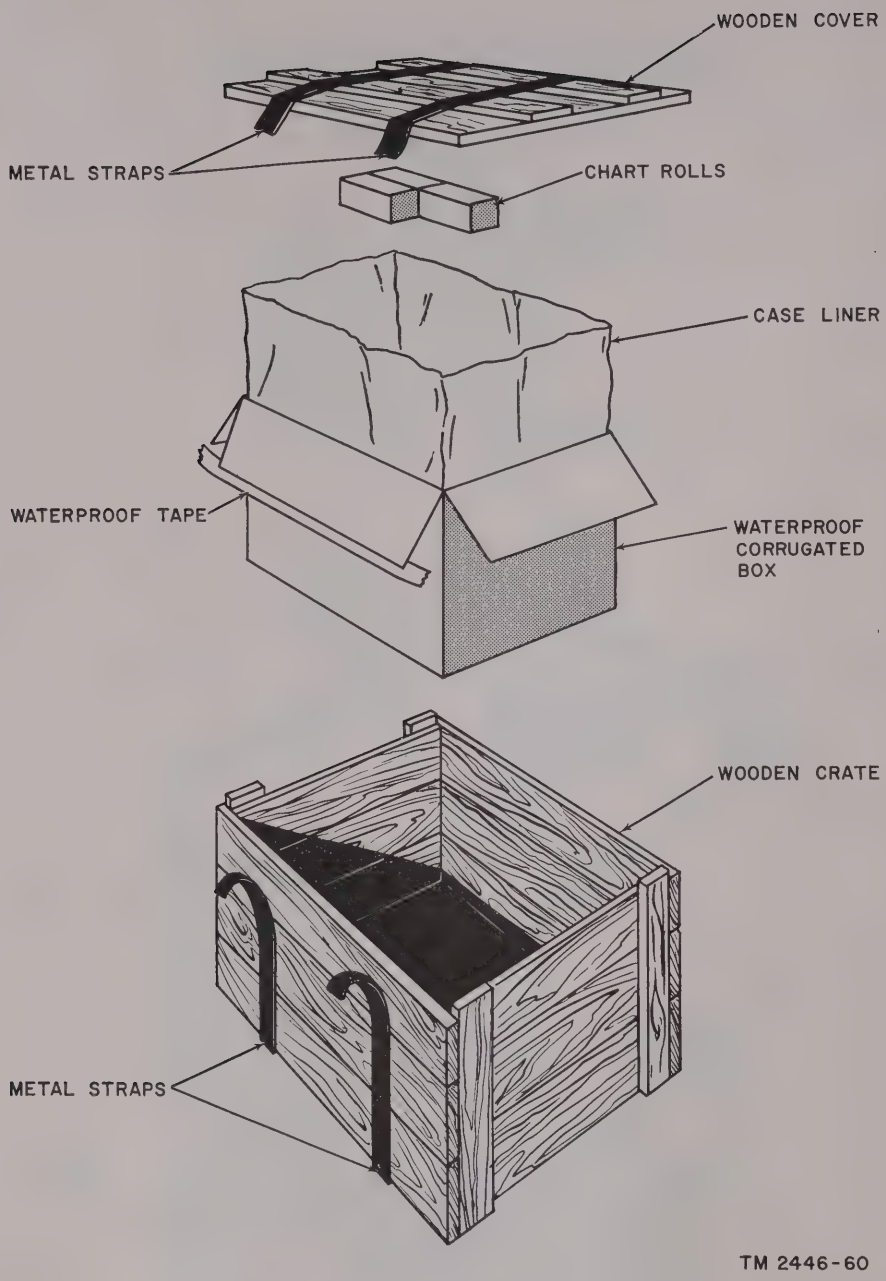

Figure 7. Chart rolls, packing and packaging diagram.

Section II. SITING, INSTALLING, AND CHECKING EQUIPMENT

12. Siting

a. Wind Speed Detector, Wind Direction Detector, and Tripod.

(1) Select a location for the installation of the detectors where there is (as nearly as possible) an unobstructed wind flow from all directions and where they will be readily accessible for inspection and servicing. Proper exposure of the detectors is most important to insure indications of actual wind conditions. The location selected should be large enough to accommodate the three mounting feet of the tripod, which are spaced 120° apart and cover a diameter of approximately 4.8 feet.

Note. Avoid any location where the detectors would be subjected to eddies of wind from any

nearby object, or where they may be struck by flue gases or engine exhaust which may cause malfunctioning of the instrument.

(2) The tripod may be mounted on concrete, wood, or on the ground. The surface should be reasonably level and strong enough to support the weight of the wind speed and the wind detectors, the tripod, the nitrogen tank, and the operator. The mounting surface also must sustain the installation under high wind intensities.

b. Amplifier-Power Supply, Recorder, and Vibrator-Inverter. Select a location for the amplifier-power supply, the recorder, and the vibrator-inverter within 600 feet of the tripod location. To maintain accuracy, the wind speed and wind direction cords must not exceed 600 feet in length. The amplifier-power supply, the recorder, and the vibrator-inverter should be placed in a sheltered area. The recorder should be placed on a reasonably level table or shelf, or mounted on a wall where it may be read easily by the operator (par. 18). The rear panel of the equipment must be accessible.

13. Tools and Materials Required for Installation

The following tools and materials are required to install the wind measuring set:

Screw driver, ¼-inch wide blade
Long-nosed pliers
Allen wrench, ⅛-inch
Allen wrench, $\frac{1}{16}$-inch
Soldering iron
Open-end wrench, ⅝-inch
Open-end wrench, ¼-inch
Adjustable crescent wrench, 6-inch
Electrical cable, two-conductor, No. 20 AWG (length depends on installation).
Electrical cable, four-conductor, No. 20 AWG (length depends on installation).

14. Installation of Tripod

(fig. 8)

To install the tripod, proceed as follows:

a. Extend the tripod legs far enough to support the tripod in the vertical position. Tighten the thumbscrew in the sliding collar. Connect the guy wires to the roll pins on the tripod legs and to the studs on the reducer fitting.

b. Loosen the thumbscrew in the sliding collar and extend the legs by pushing down on the sliding collar until the guy wires are taut. Tighten the thumbscrew securely.

c. Place the crossarm socket over the end of the inner shaft. Turn the crossarm at right angles to the prevailing wind and securely tighten the setscrew in the crossarm socket.

d. Secure the tripod legs to the mounting surface with a ½-inch diameter bolt, lag screw, or use a stake in each mounting foot.

15. Installation of Wind Speed Detector and Wind Direction Detector

(figs. 9 and 10)

Caution: Handle the wind speed and wind direction detectors very carefully. Protect the rotating heads on the drive shafts. The bearings in the rotating heads are precision balanced; even slight misalinement will affect the accuracy of the wind measuring set.

To install the wind speed and wind direction detectors, proceed as follows:

a. Wind Speed Detector.

(1) Loosen the screw that attaches each slide fastener (fig. 10) to the bottom of the wind speed detector housing. Slide the two fasteners in and pull down the housing.

(2) Check to see that the phototube and the amplifier tube are seated in their sockets (fig. 9).

(3) Replace the housing. Slide the fasteners outward to retain the cover, and tighten the screws.

(4) Loosen the setscrew. Insert the tubular rod (fig. 10) of the wind speed detector into one of the split holes near the end of the crossarm. Insert the tubular rod through the hole in the crossarm so that it extends approximately 1¼ inches below the crossarm. Securely tighten the setscrew in the end of the crossarm.

(5) Hold the rotating head on the top of the drive shaft firmly. Aline the hub stem with the drive shaft and place the hub stem of the anemometer into the upper end of the rotating head.

Caution: Hold the rotating head firmly when installing the anemometer to avoid damage to the rotating head bearings.

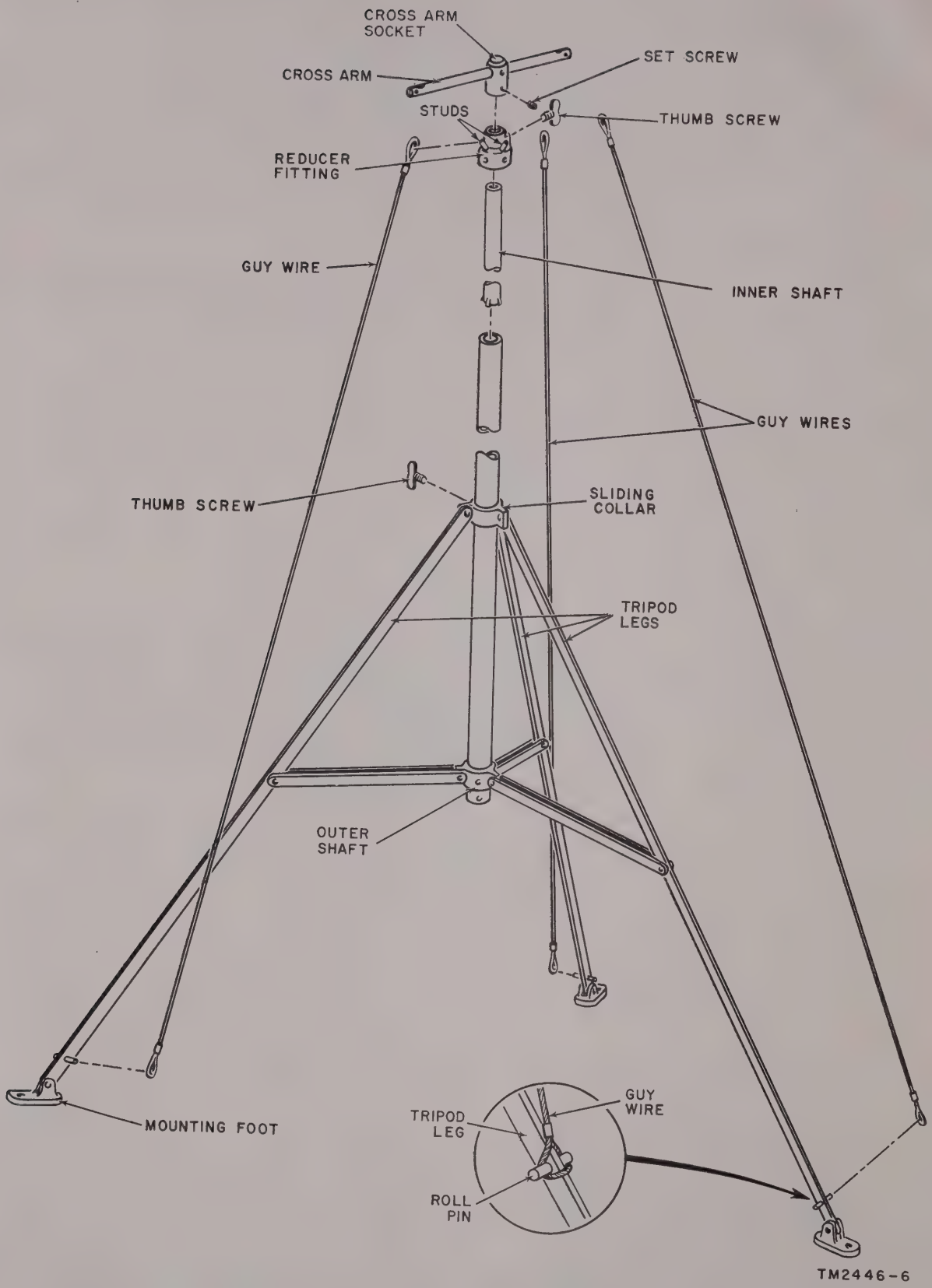

Figure 8. Assembly of tripod.

TECHNICAL MANUAL

WIND MEASURING SET AN/GMQ-12

TM 11-2446
CHANGES No. 2

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *2 January 1959*

TM 11-2446, 8 May 1957, is changed as follows:

Note. The parenthetical reference to previous changes (example: "page 5 of C 1") indicates that pertinent material was published in that change.

Add (restrictors attached) after "Hose assembly" in the following places:

Page 5, paragraph 4, chart.

Paragraph 4.1 (page 2 of C 1), chart.

Add (crate plus contents) to the heading of the weight column in the following places:

Page 8, paragraph 9, subparagraph *a.1* (page 4 of C 1), chart.

Page 9, paragraph 10, chart.

Paragraph 10, chart, weight column. Make the following changes:

Item 1, change "37" to: 93.

Item 2, change "55" to: 99.

Item 3, change "65" to: 163.

Item 4, change "80" to: 219.

Item 5, change "25" to: 175.

Change "total weight" from "262" to: 749.

Page 15, paragraph 15. Delete subparagraph *c*(2) and substitute:

(2) Check to see that a restrictor is screwed into each end of the short branches of the hose assembly. (The restrictor further reduces the flow of nitrogen from the reducing valve on the tank to the detector mechanisms and should not be disassembled.) Screw each restrictor (with hose assembly attached) into the bottom of the tubular rod of each detector. Tighten the fitting nut at each restrictor and at the tee connection.

Page 16, figure 10. Change callouts "FILTER" to: RESTRICTOR.

[AG 413.6 (9 Dec 58)]

By Order of *Wilber M. Brucker*, Secretary of the Army:

MAXWELL D. TAYLOR,
General, United States Army,
Chief of Staff.

Official:

R. V. LEE,
Major General, United States Army,
The Adjutant General.

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USA Elct PG (1)
Sig Lab (5)
Sig Fld Maint Shops (3)
USA Ord Msl Comd (3)
Fld Comd, AFSWP (5)
Mil Dist (1)
Sector Comd, USA Corps (Res) (1)
USA Corps (Res) (1)
JBUSMC (2)
Units organized under following TOE's:
11–7 (2)
11–16 (2)
11–57 (2)
11–500 (AA–AE) (2)
11–557 (2)
11–587 (2)
11–592 (2)
11–597 (2)

NG: State AG (3); units—same as Active Army except allowance is one copy to each unit.
USAR: None.
For explanation of abbreviations used, see AR 320–50.

U. S. GOVERNMENT PRINTING OFFICE: 1959

TECHNICAL MANUAL

WIND MEASURING SET AN/GMQ-12

TM 11-2446

CHANGES No. 1

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *10 March 1958*

TM 11-2446, 8 May 1957, is changed as indicated so that the manual also applies to the following equipment:

Nomenclature	*Order No.*	*Serial No.*
Wind Measuring Set AN/GMQ-12	51024-Phila-57	1 through 93

Page 3, chapter 1. Add the following note below the title of chapter 1:

Note. Wind Measuring Set AN/GMQ-12 procured on Order No. 51024-Phila-57 is similar to Wind Measuring Set AN/GMQ-12 covered in the basic manual. The major components of Wind Measuring Set AN/GMQ-12 (Order No. 51024-Phila-57) are listed below opposite the similar corresponding components of Wind Measuring Set AN/GMQ-12 covered in the basic manual. Information in the basic manual applies to both sets and to their corresponding components unless otherwise specified.

Wind Measuring Set AN/GMQ-12 (Order No. 51024-Phila-57)	Wind Measuring Set AN/GMQ-12
Amplifier - Power Supply AM-1618A/GMQ-12	Amplifier - Power Supply AM-1618/GMQ-12
Wind Direction and Wind Speed Recorder RO-64A/GMQ-12	Wind Direction and Wind Speed RO-64/GMQ-12
Vibrator - Inverter PP-1689A/GMQ-12	Vibrator - Inverter PP-1689/GMQ-12
Meteorological Tripod MT-1825A/GMQ-12	Meteorological Tripod MT-1825/GMQ-12

Add the following note to the figures listed below:

NOTE:

METEOROLOGICAL TRIPOD MT-1825A/GMQ-12 DIFFERS IN CONSTRUCTION FROM METEOROLOGICAL TRIPOD MT-1825/GMQ-12.

Page 2, figure 1.

Page 4, figure 2.

Add "(only)" after AN/GMQ-12 in the following places:

Page 5, paragraph 4, heading.

Page 6, figure 3, caption.

Page 5, paragraph 4. Add paragraph 4.1 after paragraph 4.

4.1. Components of Wind Measuring Set AN/GMQ–12 (Order No. 51024–Phila–57)

Component	Quantity	Dimensions (in.)			Volume (cu ft)	Weight (lb)
		Height	Depth	Width		
Wind Speed Detector T–627/GMQ–12	1	15	3		[1] 0. 0614	1½
Wind Direction Detector T–628/GMQ–12	1	15	3		[2]. 0614	1½
Amplifier-Power Supply AM–1618A/GMQ–12	1	7½	5⅞	17	. 433	21
Vibrator-Inverter PP–1689A/GMQ–12	1	7½	5⅞	17	. 433	30½
Wind Direction and Wind Speed Recorder RO–64A/GMQ–12, including:	1	14½	9¼	18⅛	1. 44	50
Wind speed spring chart drive with three sets of change gears and a crank.	1	12⅛	4½	8	. 253	9½
Wind direction spring chart drive with three sets of change gears.	1	12⅛	4½	8	. 253	6½
Chart coupler	1					
Motor coupler	1					
External chart drive motor	1	6½	3¾	9½	. 134	5¾
Accessory kit consisting of:		4½	1⅞	4½	. 021	½
Eyedropper for inkwell filler	1					
Inkwell filler	1					
Metal pen point	1					
Meteorological Tripod MT–1825A/GMQ–12	1	108		58		21
Power cord (with adapter connectors)	3			180 (lg)		3¾
Power cord (external chart drive motor)	1			12		3 oz
Wind direction cord	1			300 (lg)		1½
Wind speed cord	1			300 (lg)		2¼
Recorder cord	2			120 (lg)		1½
Shorting plug	1		1	2		3 oz
Chrono plug	1		1	2		3 oz
Hose assembly	1			240 (lg)		1½
Reducing valve	1	7	7	7¾		6¼
Carrying case No. 1	1	7¼	9¼	55¼	2. 15	33
Carrying case No. 2	1	15½	22	33	6. 51	52
Carrying case No. 3	1	18½	22	30½	7. 19	54
Wind direction chart rolls	100	2¼	2⅜	6½	2. 01	62
Wind speed chart rolls	100	2¼	2⅜	6½	2. 01	62
Running spares (par. 6)	1 set					
Total weight						432

[1] Less anemometer.

[2] Less wind vane.

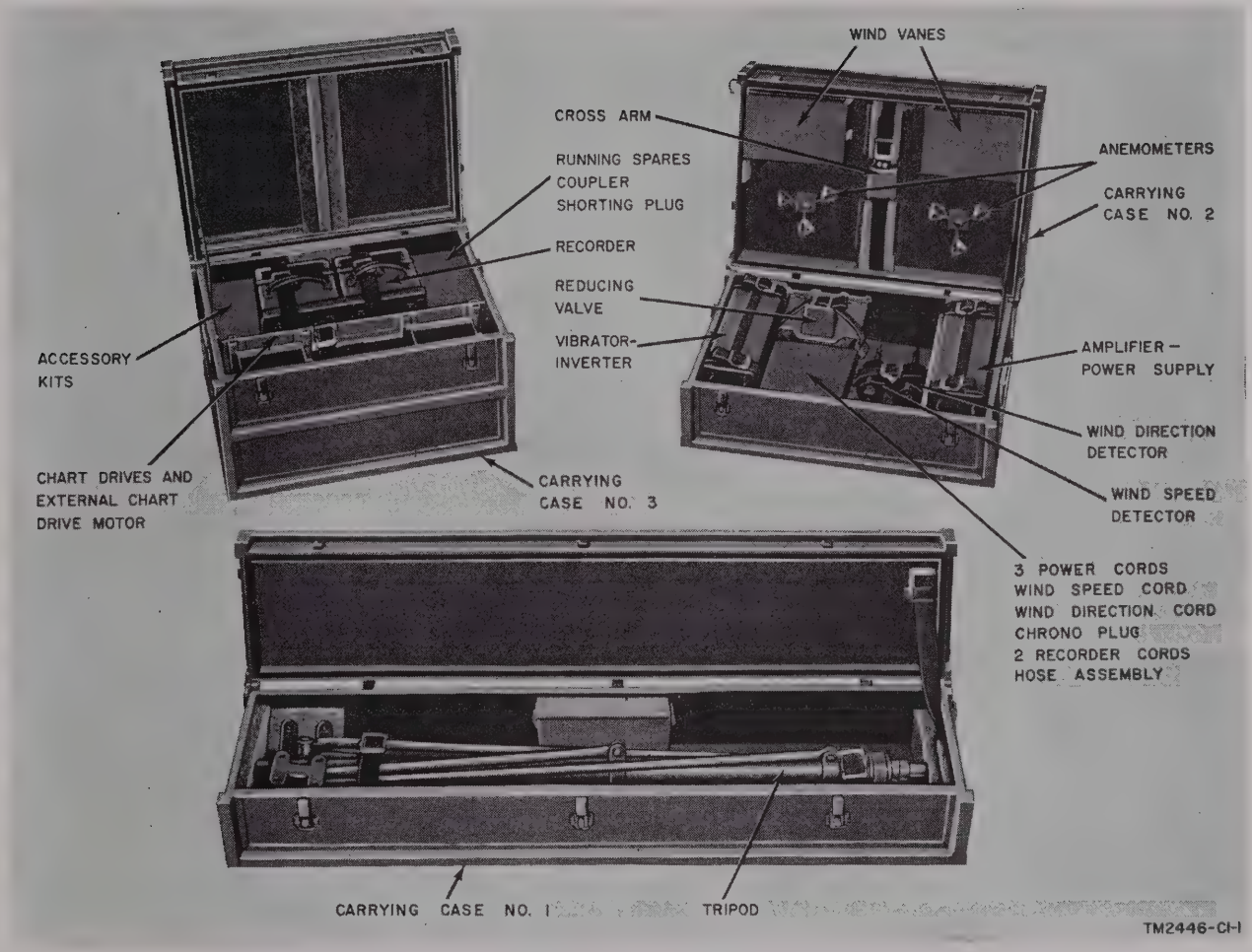


Figure 3.1. (Added) *Wind Measuring Set AN/GMQ–12 (Order No. 51024–Phila–57) (less chart rolls) packed in its carrying cases.*

Page 6. Delete paragraph 6 and substitute:

6. Running Spares

The running spares supplied with each wind measuring set are as follows:

Running spare	AN/GMQ–12 (TM 11–2446, fig. 4)	AN/GMQ–12 (Order No. 51024–Phila–57)
Tube 7526	1	
Tube JRC 5726/6AL5W		1
Tube 6627	1	
Tube 6627/OB2WA		2
Tube 5965	1	2
Tube 6087	1	
Tube CHS 5Y3 WGTA		2
Tube 5751	1	
Tube JRC 5751		2
Phototube 170–590–74	1	1
Pilot lamp, No. 44	1	12
Pilot lamp, type NE51	1	3
Exciter lamp 170–590–75	2	2
Fuse, 2 ampere, type 2AG	6	6
Fuse, 25 ampere, type 3AG	6	6
Anemometer, 6660–566–4892		1
Wind vane, 6660–566–5017		1
Vibrator, type 6VR6		1

Page 8, paragraph 9. Make the following changes:

Subparagraph *a*, Description column. Add "(dry nitrogen)" after "cubic feet".

Add paragraph 9.1 after paragraph 9.

9.1. Differences in Models

The following changes and additions have been made on Wind Measuring Set AN/GMQ–12 (Order No. 51024–Phila–57).

a. Meteorological Tripod MT–1825A/GMQ–12 is interchangeable as a complete unit with Meteorological Tripod MT–1825/GMQ–12. The maintenance parts are not interchangeable.

b. External chart drive motor connector receptacle J405 has been added to the rear of the wind speed recorder (fig. 14.1).

c. An external chart drive motor cable is supplied to electrically connect the wind speed recorder to the external chart drive motor.

d. Connector receptacle J1001 has been added to the external chart drive motor.

e. The front panels of the amplifier-power supply and vibrator-inverter chassis are secured to their housings with eight screws.

f. Two pull-out handles have been added to the front panels of the amplifier-power supply chassis and the vibrator-inverter chassis.

g. The wind measuring set is contained in three carrying cases (fig. 3.1).

Page 9, paragraph 10. Make the following changes:

Delete "(figs. 3, 5, 6, and 7)" in the heading.

Subparagraph *a:* Add "(AN/GMQ–12 only)" after the heading.

Add subparagraph *a*.1 after subparagraph *a*.

a.1. *Packaging Data AN/GMQ–12 (Order No. 51024–Phila–57).*

Crate	Dimensions (in.)			Volume (cu ft)	Weight (lb)	Contents of crate
	Height	Width	Depth			
1 of 4	11¾	13¾	61¼	5. 72	112	Carrying case No. 1 and contents (fig. 3.1).
2 of 4	20	26½	39	11. 98	191	Carrying case No. 2 and contents.
3 of 4	24	27½	37½	14. 32	221	Carrying case No. 3 and contents.
4 of 4	15½	20	36	6. 46	177	Chart rolls (fig. 7).
Total weight					701	

Subparagraph *b*. Add "(1 and 2, AN/GMQ–12 (Order No. 51024–Phila–57))" after the heading.

Subparagraph *c*. Add "(3, AN/GMQ–12 (Order No. 51024–Phila–57))" after the heading.

Subparagraph *d*. Add "(4, AN/GMQ–12 (Order No. 51024–Phila–57))" after the heading.

Page 13, paragraph 14. Make the following changes:

Delete the paragraph heading and substitute: Installation of Meteorological Tripod MT–1825/GMQ–12.

Add paragraph 14.1 after paragraph 14.

14.1. Installation of Meteorological Tripod MT–1825A/GMQ–12 (fig. 8.1)

To install the tripod, proceed as follows:

a. Position the indentation of the lower brace clamp over one of the lower positioning holes of the lower mast and tighten the hexagonal nuts.

b. Position the indentation of the upper brace clamp over one of the upper positioning holes of the lower mast, and tighten the hexagonal nuts.

c. Check the postion of the mounting feet to be certain they can be fastened to the mounting surface.

Note. The radius of the mounting feet can be changed by changing the position of the upper and lower brace clamps on the lower mast.

d. Secure the mounting feet to the mounting surface with the mounting screws.

e. Tighten the hexagonal nuts on the mounting feet.

f. Place the crossarm socket over the adapter and tighten the setscrew.

g. Turn the crossarm at right angles to the prevailing wind and tighten the compression nut.

Page 14, figure 8. Make the following changes:

Delete the caption and substitute: Assembly of Meteorological Tripod MT–1825/GMQ–12.

Page 15, paragraph 15*e*. Make the following changes.

Delete the heading and substitute: Extending Tripod MT–1825/GMQ–12.

Add subparagraph *f* after subparagraph *e*.

f. Extending Meteorological Tripod MT–1825A/GMQ–12. When the wind speed and wind direction detectors have been installed and connected (*a–d* above), loosen the compression nut (fig. 8.1). Raise the upper mast of the tripod to the desired height and tighten the compression nut securely. The tripod may be extended to a height of 9 feet.

Note. Be very careful not to twist the upper mast; the sighting bar alinement of the wind direction detector may be changed.

Page 17, paragraph 17*a*(2), line 2. After "rear panel", add: (retaining screws on the sides of the housing, AM–1618A/GMQ–12).

Page 17, paragraph 18*a*(3). At the end of subparagraph (3), add: (six holes, RO–64A/GMQ–12 (fig. 14.1)).

Page 18, paragraph 18*b*(4). At the end of subparagraph (4), add: (Connect one end of the external chart drive motor cable (par. 9.1*c*) to connector receptacle J1001 (par. 91.1*d*) of the external chart drive motor and the other end to external chart drive motor connector receptacle J405, AN/GMQ–12 (Order No. 51024–Phila–57)).

Page 19, figure 14. Make the following changes:

Delete the figure caption and substitute: Wind Direction and Wind Speed Recorder RO–64/GMQ–12, rear view with mounting dimensions.

Page 21, figure 16. Make the following changes:

Change "NOTE" to "NOTES" and number the existing note "1".

Change "(SEE NOTE)" to: (NOTE 1).

Add the following:

2. ON WIND MEASURING SET AN/GMQ–12 (ORDER NO. 51024–PHILA–57), THE EXTERNAL CHART DRIVE MOTOR CABLE TERMINATED BY CONNECTORS P1002 AND P1003 IS PLUGGED INTO EXTERNAL CHART DRIVE MOTOR CONNECTOR RECEPTACLE J405 ON THE REAR SIDE OF THE WIND SPEED RECORDER AND CONNECTOR J1001 ON THE EXTERNAL CHART DRIVE MOTOR.

Page 25, paragraph 20*h*. After subparagraph *h*, add the following note:

Note. The nitrogen tank will last approximately 90 days. Note the date of first use for replacement.

Page 96, figure 59. In the legend, after item 52, add: (connector J1001, AN/GMQ–12 (Order No. 51024–Phila–57)).

Page 97. Add paragraph 77.1 after paragraph 77.

77.1. Disassembly of Meteorological Tripod MT–1825A/GMQ–12

a. Loosen the setscrew (fig. 8.1) on the crossarm socket and remove the crossarm from the adapter.

b. Remove the mounting screws (1, fig. 60.1) and the washers (2); remove the tripod from the mounting surface.

c. Remove the hexagonal nuts (5) and the lockwashers (4) from the screws (6).

d. Remove the screws (6), the spacers (7), and the mounting feet (16).

e. Remove the hexagonal nuts (22) and the lockwashers (23) from the screws (3).

f. Remove the screws (3), the lower brace clamps (15), and the short braces (14).

g. Remove the hexagonal nuts (24) and the lockwashers (25) from the screws (26).

h. Remove the screws (26), the upper brace clamps (27), and the long braces (13).

i. Remove the screws (18) and remove the name plate (17) from the lower mast (12).

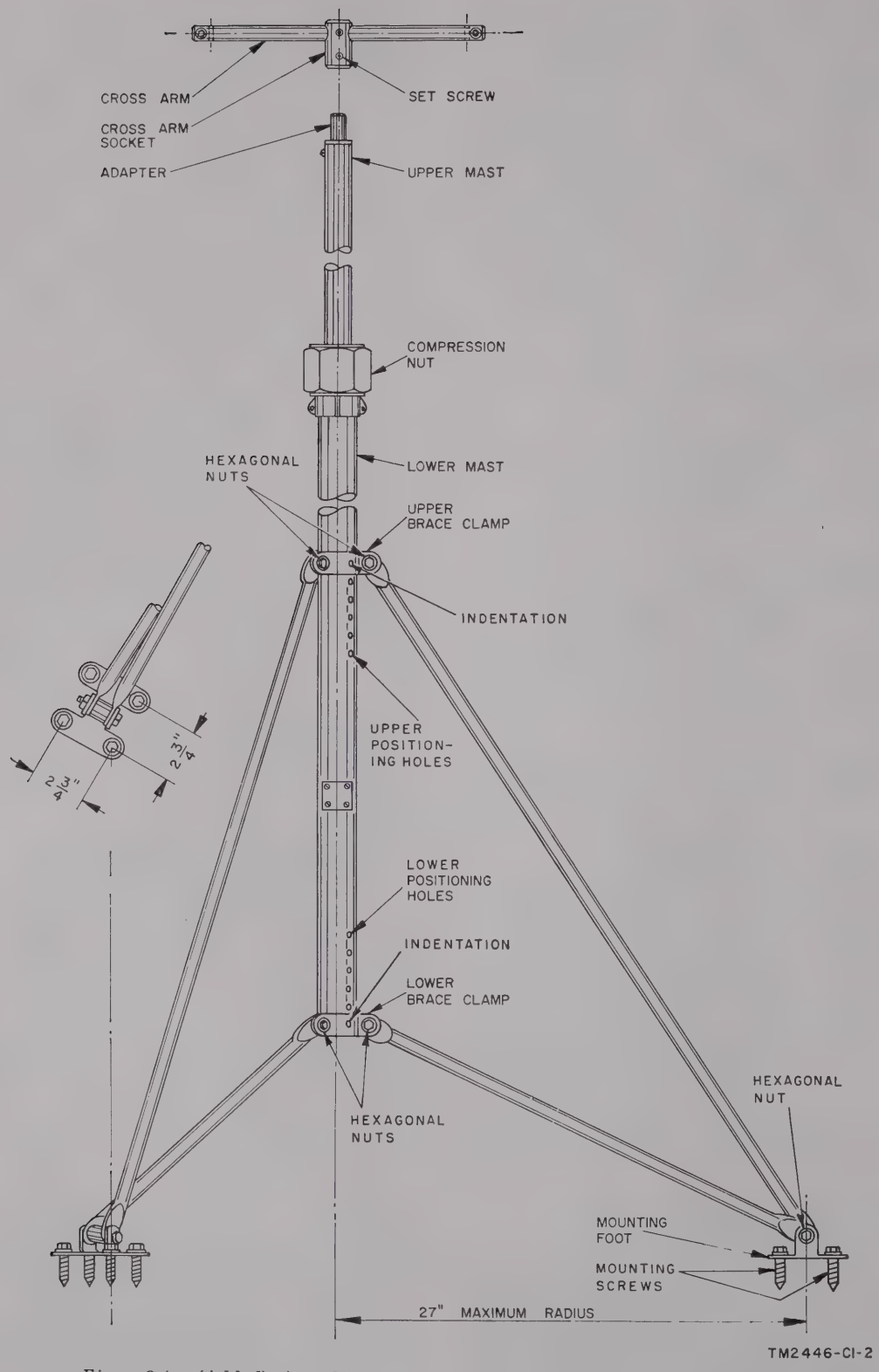


Figure 8.1. (Added) *Assembly of Meteorological Tripod MT–1825A/GMQ–12.*

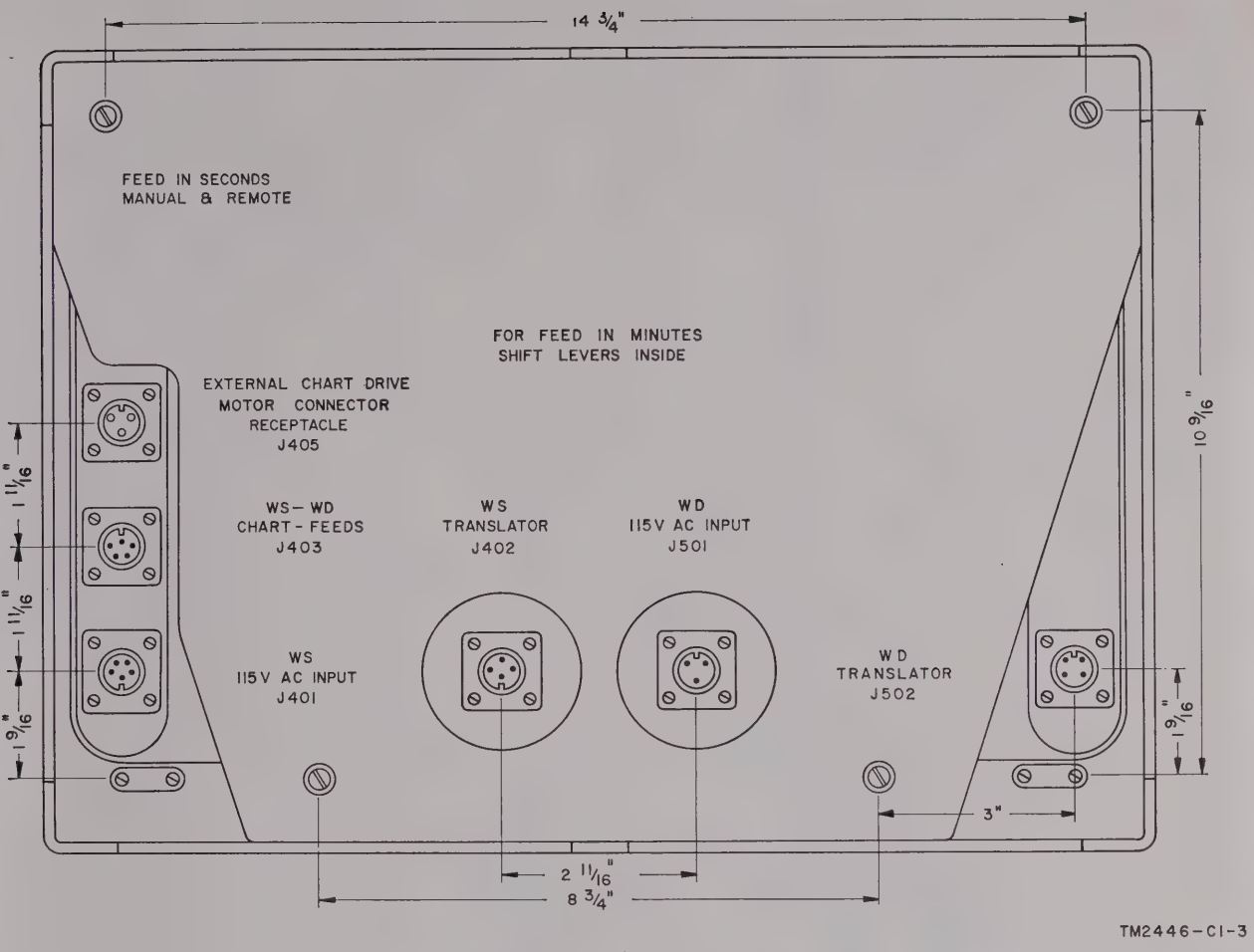


Figure 14.1. (Added) *Wind Direction and Wind Speed Recorder RO–64A/GMQ–12, rear view with mounting dimensions.*

j. Remove the screw (21) and the washer (20); remove the adapter (19) from the upper mast (11).

k. Remove the compression nut (10), the bushing (9), and the washer (8).

l. Slide the upper mast (11) out through the bottom of the lower mast (12).

Page 110. Add paragraph 87.1 after paragraph 87.

87.1. Assembly of Meteorological Tripod MT–1825A/GMQ–12

(fig. 60.1)

a. Slide the upper mast (11) through the bottom of the lower mast (12) until approximately 12 inches of the upper mast extends from the top of the lower mast.

b. Replace the washer (8) with its cambered side upward and replace the bushing (9).

c. Replace the compression nut (10) and tighten it to the lower mast (12).

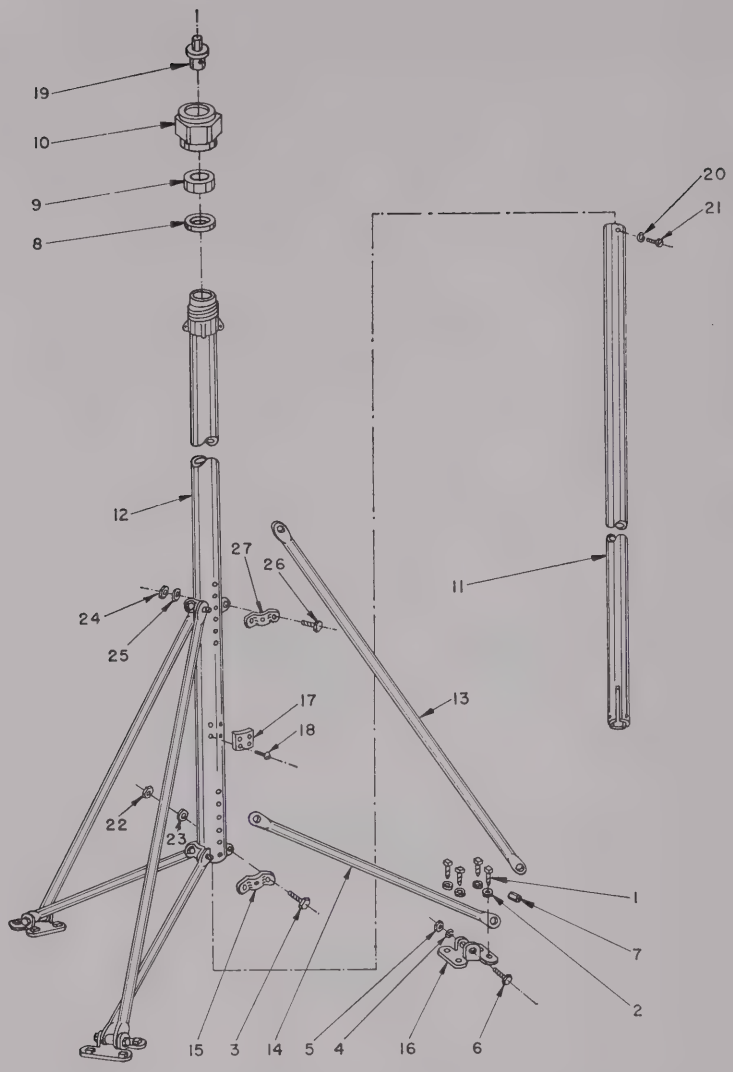
d. Replace the adapter (19) and secure it to the upper mast (11) with the washer (20) and the screw (21).

e. Position the long braces (13) and the upper brace clamps (27) and secure them to the lower mast (12) with the screws (26), the lockwashers (25), and the hexagonal nuts (24).

f. Position the short braces (14) and the lower brace clamps (15) and secure them to the lower mast (12) with the screws (3).

g. Attach the spacers (7) and the mounting feet (16) to the long braces (13) and short braces (14) with the screws (6), the lockwashers (4), and the hexagonal nuts (5).

h. Position the nameplate (17) and attach it to the lower mast (12) with the screws (18).



TM2446-C1-4

1	Mounting screw (H301).	8	Washer (A 302).	15	Lower brace clamp (A 309).	21	Screw (H309).
2	Washer (H302).	9	Bushing (A 303).	16	Mounting foot (A 310).	22	Hexagonal nut (H305).
3	Screw (H303).	10	Compression nut (A 304).	17	Nameplate (N301)	23	Lockwasher (H304).
4	Lockwasher (H304).	11	Upper mast (A 305).	18	Screw (H307).	24	Hexagonal nut (H305).
5	Hexagonal nut (H305).	12	Lower mast (A 306).	19	Adapter (A 311).	25	Lockwasher (H304).
6	Screw (H306).	13	Long brace (A 307).	20	Washer (H308).	26	Screw (H303).
7	Spacer (A 301).	14	Short brace (A 308).			27	Upper brace clamp (A 309).

Figure 60.1. (Added) *Meteorological Tripod MT–1825A/GMQ–12 exploded view.*

i. Place the crossarm socket (fig. 8.1) over the adapter and tighten the setscrew.

Figure 65 (fold-out). Add the following to the notes:

8. ON THE AN/GMQ–12 (ORDER NO. 51024–PHILA–57), THE EXTERNAL CHART DRIVE MOTOR IS PROVIDED WITH CONNECTOR J1001, AND THE REAR OF THE WIND SPEED RECORDER IS PROVIDED WITH CONNECTOR J405.

9. AN EXTERNAL CHART DRIVE MOTOR CABLE, TERMINATED BY CONNECTORS P1002 AND P1003, IS PROVIDED FOR CONNECTING THE EXTERNAL CHART DRIVE MOTOR (8 ABOVE) TO THE WIND SPEED RECORDER.

[AG 413.6 (3 Mar 58)]

By Order of *Wilber M. Brucker*, Secretary of the Army:

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General, United States Army,
Chief of Staff.

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HERBERT M. JONES,
Major General, United States Army,
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USA Armor Bd Test Sec	WRAMC	11–16
USA Air Def Bd Test Sec	AFIP	11–57
USA Arctic Test Bd	AMS	11–127
USCONARC	Port of Emb (OS)	11–128
US ARADCOM	Trans Terminal Comd	11–500 (AA–AE)
OS Maj Comd	Army Terminals	11–557
Log Comd	OS Sup Agcy	11–587
MDW	USA Sig Pub Agcy	11–592
Armies	USA Sig Comm Engr Agcy	11–597
Corps	USA Comm Agcy	
Div	TASSA	

NG: State AG; units—same as Active Army.
USAR: None.
For explanation of abbreviations used, see AR 320–50.

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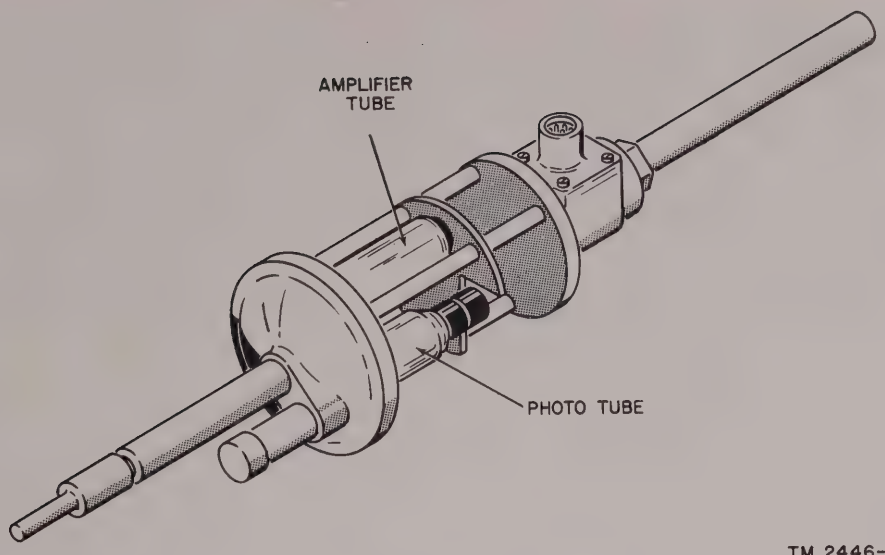


Figure 9. Wind speed detector, location of tubes.

b. Wind Direction Detector.

(1) Hold the rotating head on the drive shaft of the wind direction detector firmly. Place the hub stem of the wind vane into the end of the rotating head of the drixe shaft. Seat the key on the hub stem in the slotted keyway in the rotating head.

Caution: Hold the rotating head firmly when installing the wind vane to prevent damage to the rotating head bearings.

(2) Insert the tubular rod of the wind direction detector into the hole in the crossarm. Push the tubular rod through the hole so that it extends approximately 1¼ inches below the crossarm. Do not tighten the setscrew.

(3) If a prevailing wind is present, hold the detector in position until the wind vane points in the direction of the prevailing wind. Turn the tubular rod until the sighting bar is parallel with the wind vane and pointing into the wind. Tighten the setscrew in the end of the crossarm.

Note. When the wind vane and the sighting bar are parallel, the recorder will read midscale. *Do not move the sighting bar on the tubular rod.*

(4) To obtain wind directions with respect to north, line up the sighting bar ((3) above) with a fixed object in the general direction of the prevailing wind. Take a compass reading on the fixed object. Record the compass readings in degrees. When the recorder is installed (par. 18), stick a piece of masking tape or adhesive tape on the front of the wind direction recorder cover. Write the compass reading on the tape for a reference during operation.

c. Connecting Hose Assembly.

(1) Remove the plug (fig. 10) in the bottom of each tubular rod in the wind speed and wind direction detectors. Save the plugs for use when storing or transporting the wind measuring set.

(2) Check to see that a filter is screwed into each end of the short branches of the hose assembly. Screw each filter (with the hose assembly attached) into the bottom of the tubular rod of each detector. Tighten the fitting nut at each filter and at the tee connection.

d. Connecting Cords (fig. 16).

(1) Connect the polarized female connector on the end of the wind speed cord to the male connector on the wind speed detector.

(2) Connect the polarized female connector on the end of the wind direction cord to the male connector on the wind direction detector.

e. Extending Tripod. When the wind speed and wind direction detectors have been installed and connected (*a* through *d* above), loosen the thumbscrew in the reducer fitting (fig. 8). Raise the inner shaft of the tripod to the desired height and tighten

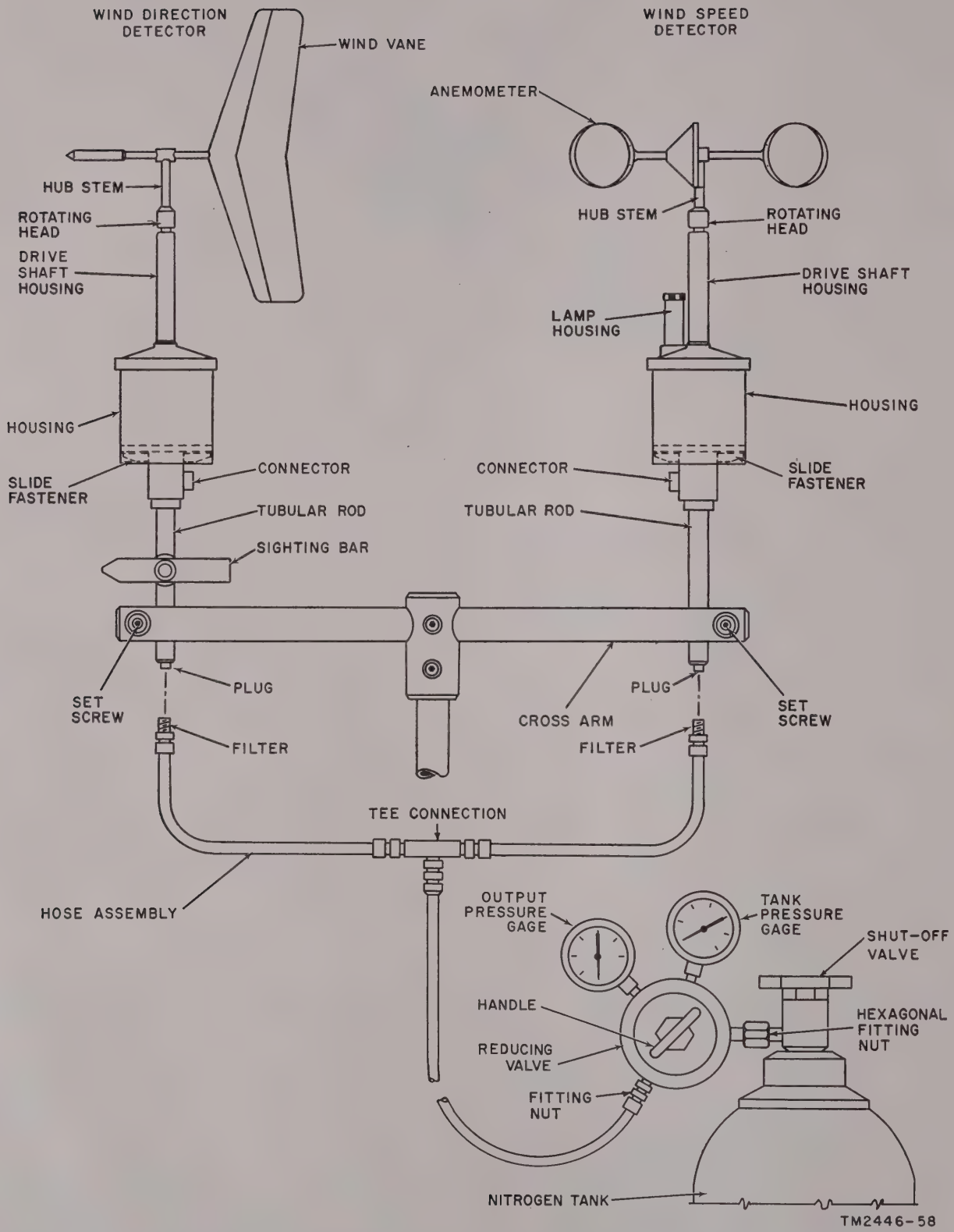


Figure 10. Installation of wind speed detector, wind direction detector, and reducing valve.

the thumbscrew securely. The tripod may be extended to a height of 9 feet.

Note. Be very careful not to twist the inner shaft; the sighting bar alinement of the wind direction detector may be changed.

16. Installation of Reducing Valve

(fig. 10)

Install the reducing valve as follows:

a. Place the nitrogen tank (par. 9) next to the tripod.

b. Unscrew the valve cover on the top of the nitrogen tank. Screw the hexagonal fitting nut on the reducing valve onto the nitrogen tank fitting and tighten the hexagonal fitting nut (fig. 10) securely.

c. Screw the fitting nut on the end of the hose assembly onto the small male fitting protruding from the side of the reducing valve. Tighten the fitting nut securely.

d. Turn the handle of the reducing valve all the way out.

e. Open the shutoff valve on the top of the nitrogen tank.

Caution: Releasing the nitrogen too rapidly will burst the hose or damage the wind speed and the wind direction detectors.

17. Installation, Amplifier-power Supply and Vibrator-inverter

a. Amplifier-power Supply.

(1) Place the amplifier-power supply on a bench or shelf, with access to the front panel.

(2) Loosen the center retaining screw in the top of the rear panel. Slide the panel-chassis assembly out of the housing and check to see that all tubes are in their proper sockets (fig. 11). Replace the housing.

(3) Check the 2-ampere fuse located on the rear panel of the amplifier-power supply (fig. 12).

b. Vibrator-inverter.

(1) Place the vibrator-inverter within 12 feet of the amplifier-power supply so that the power cord can be connected without bending it at sharp angles.

(2) Check the 25-ampere fuse located on the rear panel of the vibrator-inverter (fig. 13).

18. Installation of Recorder

a. Installing Recorder on Wall. The recorder is normally operated on a bench or shelf. If the recorder is to be installed on a wall or vertical support, provide for cable connections to the rear of the recorder. Install the recorder on a wall or a vertical support as follows:

(1) Refer to figure 14 for the mounting hole dimensions and drill four ¼-inch diameter holes in the wall.

(2) Remove the back panel (fig. 15) from the recorder by removing the retaining screws. The back panel is not used when the recorder is wall mounted.

(3) Drill five 1½-inch diameter holes in the wall for cable connections (fig. 14).

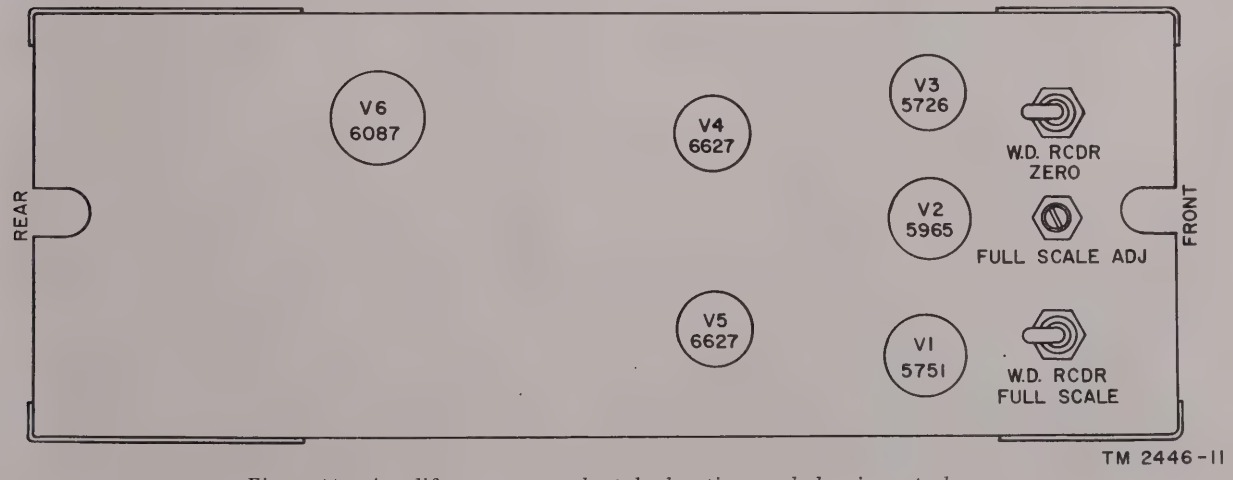


Figure 11. Amplifier-power supply, tube locations and chassis controls.

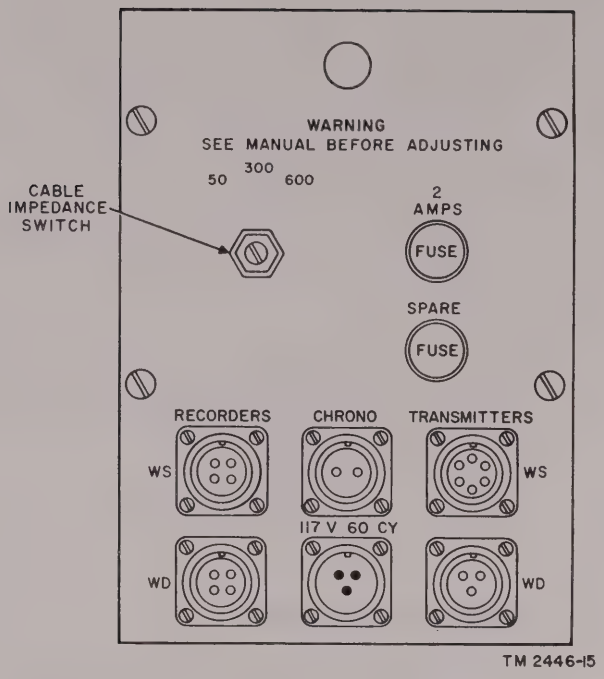


Figure 12. Amplifier-power supply, connectors and fuse locations.

(4) Lift the recorder and position it over the mounting holes in the wall. Insert a ¼–24 bolt through each mounting hole and screw the bolts into the threaded holes in the mounting chassis.

b. Installing External Chart Drive Motor (fig. 15). Install the external chart drive motor as follows:

(1) Remove the two large capnuts located on the right-hand side of the wind speed recorder case.

(2) Remove the external chart drive motor from the mounting board (fig. 2) by removing the attaching bolts, washers, and nuts. Place the motor coupler (fig. 15) over the end of the drive shaft protruding from the right-hand side of the wind speed recorder case. Seat the shaft pins in the slots of the motor coupler.

(3) Place the motor in position on the side of the recorder case. Aline the pins in the motor shaft with the slots in the motor coupler. Slide the motor shaft into the motor coupler and the motor onto the mounting studs. Screw on the cap screws and tighten them securely.

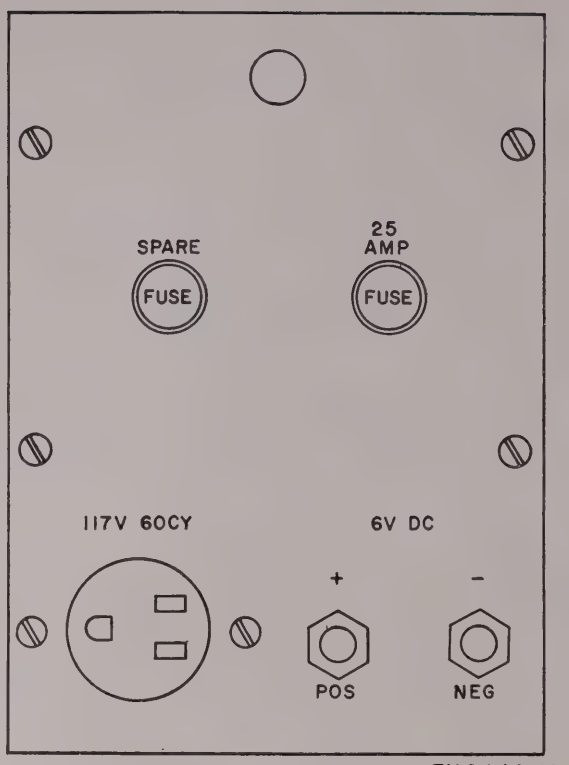


Figure 13. Vibrator-inverter, connector and fuse locations.

(4) Insert the connector plug on the external chart drive motor in the connector receptacle on the right-hand side of the recorder (fig. 16).

19. Connections
(figs. 16 and 17)

a. Ac Operation. If 110- to 125-volts ac, 60-cycle power is available, make connections in accordance with figure 16. In this application, the vibrator-inverter is not used. Make external switching arrangements for the chrono pens and the external chart drive motor (*b* and *c* below).

b. External Switch for Chrono Pens (A, fig. 17). Use two-conductor, 20 AWG insulated cable, a momentary-action push switch (par. 9), and the chrono plug supplied with the set and proceed as follows:

(1) Connect one end of the cable to the chrono plug.

(2) Connect the other end of the cable to the push switch. Label this switch *external chrono switch.*

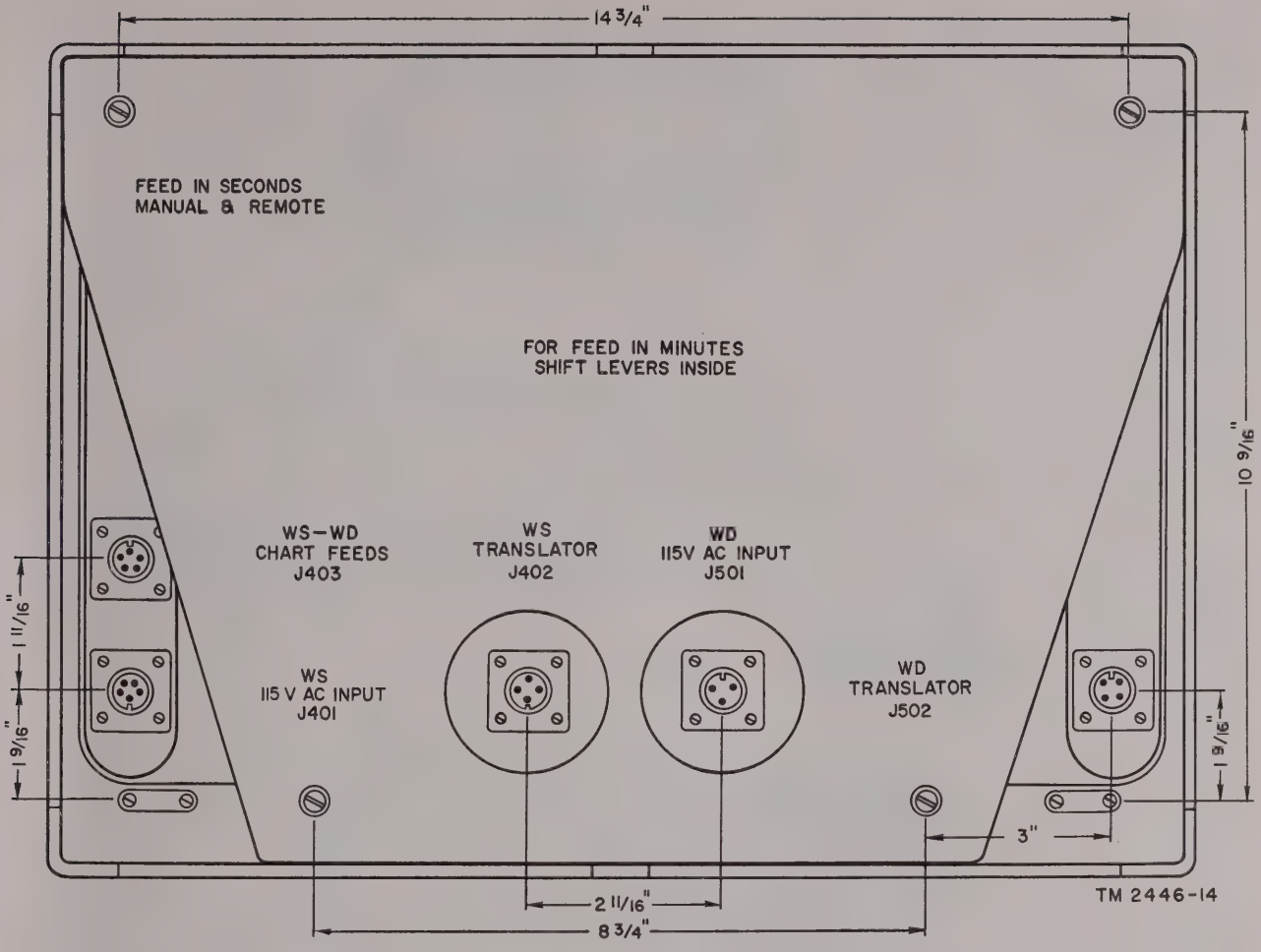


Figure 14. Recorder, rear view with mounting dimensions.

(3) Insert the chrono plug into the chrono jack on the back of the amplifier-power supply.

c. External Chart Drive Motor Switch. If the wind measuring set is not to be used in remote operation connect the shorting plug to connector WS-WD CHART FEEDS J403 (fig. 16) so that the external chart speed motor may be operated by the ON-OFF switch located on top of the external chart speed motor. If the wind measuring set is to be used with remote operation prepare the external switches for the external chart speed motor and the chart feed as follows:

(1) Obtain a length of four-conductor 20 AWG insulated cable (B, fig. 17). The length of this cable is determined by local conditions.

(2) Unscrew the nut from the back of the shorting plug and unsolder the connections between terminals A and C and terminals B and D.

(3) Solder the conductors of the cable to the shorting plug terminals A, B, C, and D.

(4) Obtain two spst toggle switches (par. 9) and mount them on an appropriate board. Connect the conductor from shorting plug terminal A to one side of one of the toggle switches and the conductor from terminal D to the other side of the switch. Label this switch *chart speed switch.* The closed position of the switch should be labeled *min.* and the open position labeled *hours.*

(5) Connect the conductor from shorting plug terminal B to one side of the second toggle switch and the conductor from terminal C to the other side of the switch. Label this switch *external chart drive motor switch.*

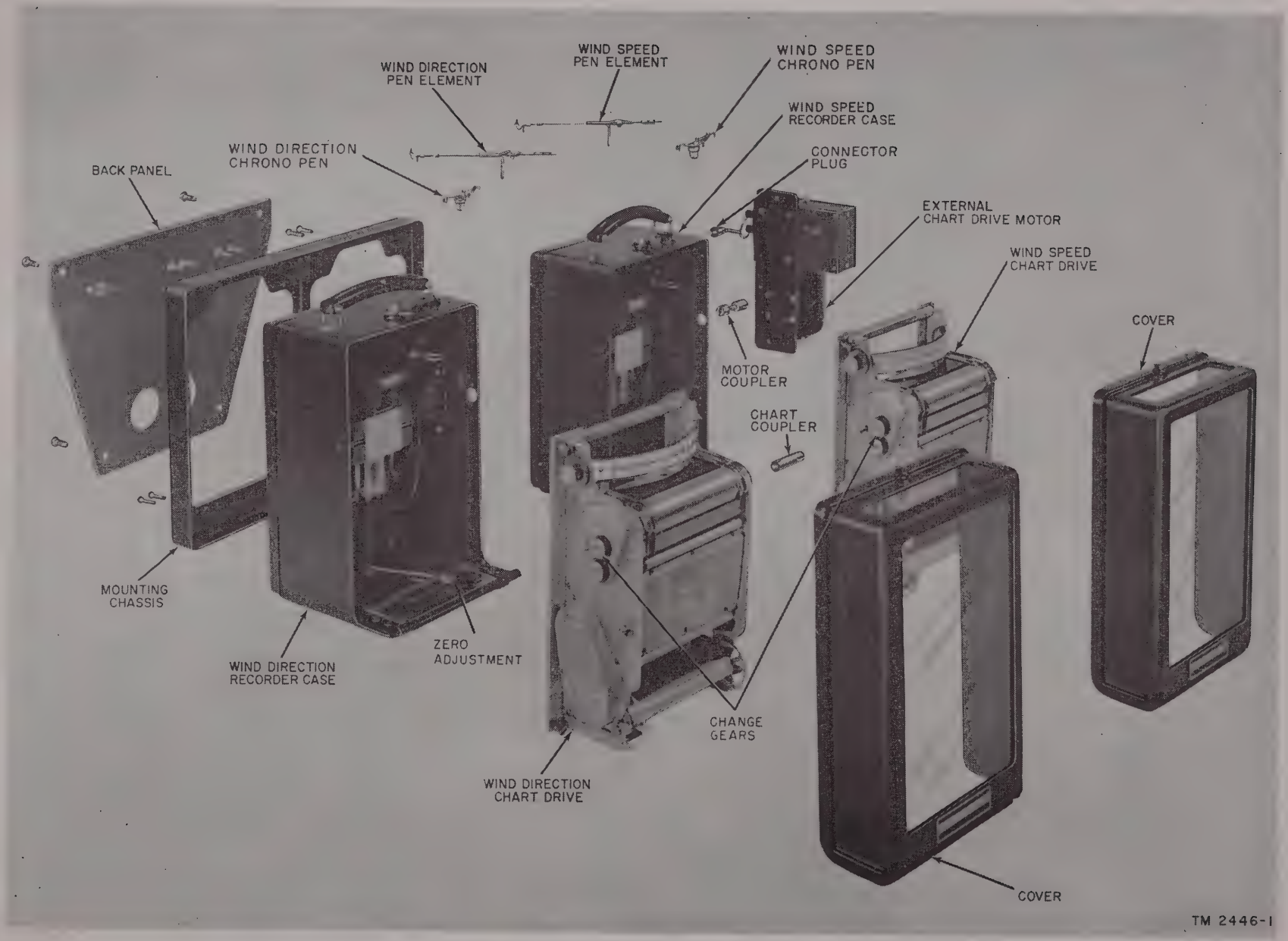


Figure 15. Recorder, chart drives, and external chart drive motor.

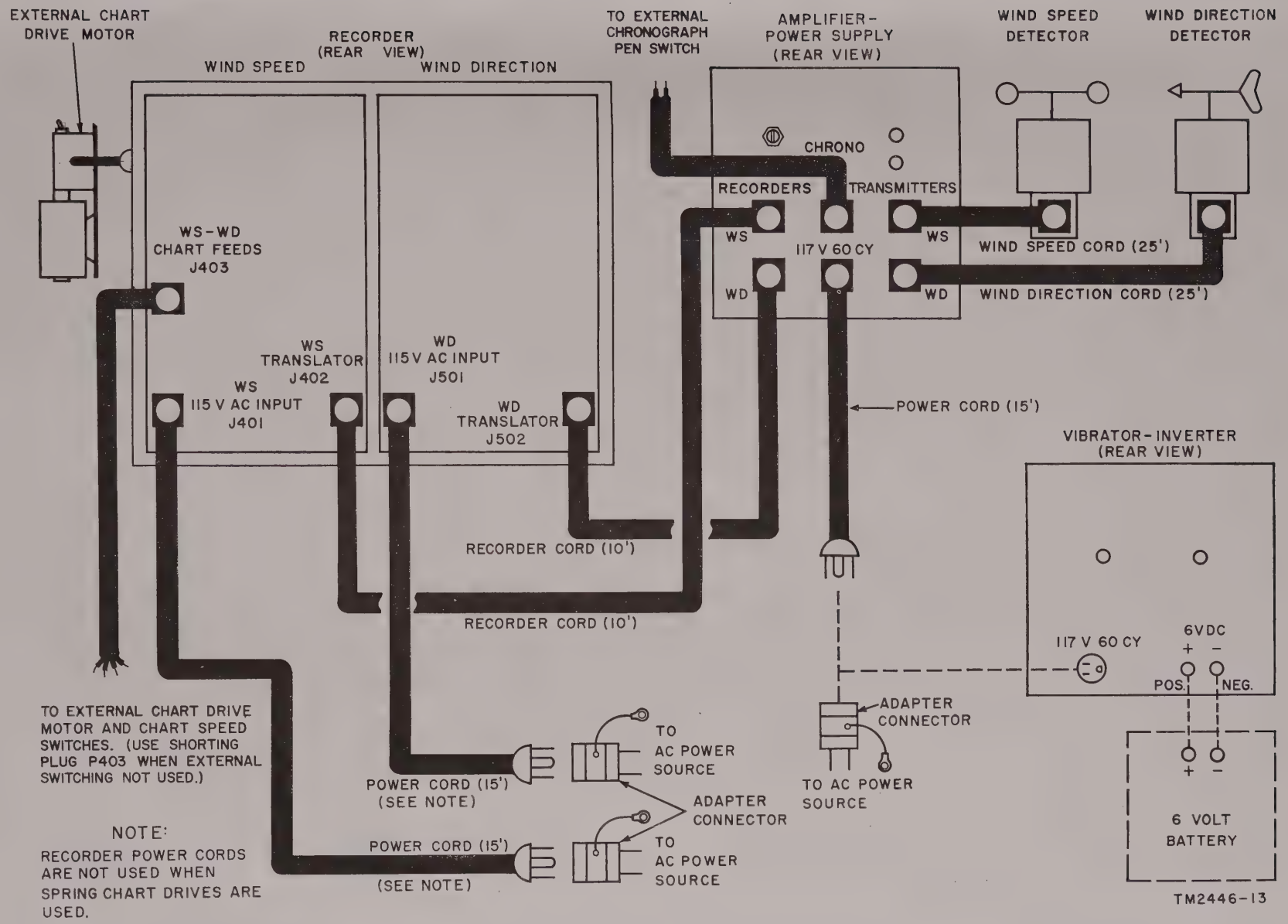


Figure 16. Wind measuring set, cord connections.

Label the closed position of the switch *on* and the open position of the switch *off*.

(6) Place the switches in a convenient location where they will be protected from weather.

(7) Connect the shorting plug to the WS-WD CHART FEEDS J403 connector on the back of the recorder (fig. 16).

d. Dc Operation. If an ac power source is not available, make connections in accordance with figure 16.

(1) Connect the power cord from the amplifier-power supply to the vibrator-inverter.

(2) Connect the vibrator-inverter to a 6-volt battery.

(3) Do not connect the two power cords from the recorder and replace the synchronous chart drives in the recorder with the spring chart drives (par. 24*a*).

(4) Connect the chrono plug (*b* above) to the CHRONO jack on the amplifier-power supply.

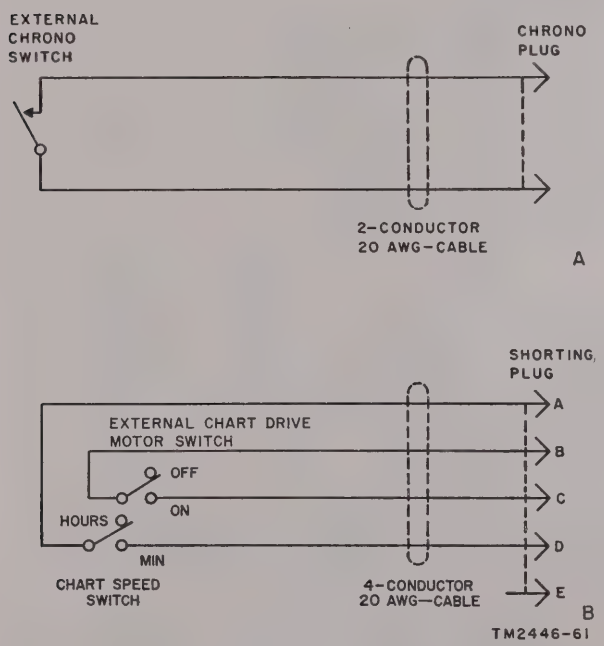


Figure 17. Chart speed and external chart drive motor switching cable diagram.

20. Adjusting and Checking Installation

a. Checking Synchronous Chart Drives. Check the synchronous chart drives in the recorder case as follows:

(1) Remove both covers from the recorder.

(2) Set the HOUR FEEDS-MIN. FEEDS switch (fig. 19) to MIN. FEEDS.

(3) Replace the change gears already installed with the two red change gears (par. 25*b*) on the change gear drive shafts on both chart drives.

(4) Set the ON-OFF switch, located on the right-hand side of both chart drives, to the ON position.

(5) Check to see that the chart feeds at exactly 3 inches per minute on both chart drives.

Note. The numbers on the right-hand margin of the chart roll are spaced at 6-inch intervals.

(6) Set the HOUR FEEDS-MIN. FEEDS switch to the HOUR FEEDS position. Check to see that the charts slow down so that their movement is just visible.

(7) Turn the ON-OFF switches to OFF and reinstall the original set of change gears that were replaced by the red change gears ((3) above).

(8) If a *chart speed switch* (fig. 17) has been installed, set the HOUR FEEDS-MIN. FEEDS switch to HOUR FEEDS position (fig. 19). Close the *chart speed switch* and check to see that the chart drives increase to minutes feed.

Note. To control the speed of the chart for *minute feed or hour feed* by the *chart speed switch,* the HOUR FEEDS-MIN. FEEDS switch must be in the HOUR FEEDS position.

(9) Do not replace the covers until the recorders have been adjusted (*c* and *d* below).

b. Checking Spring Chart Drives (fig. 20). Install the spring chart drives in the recorder (par. 24*a*), and check them as follows:

(1) Remove both covers from the recorder.

(2) Set the MIN. FEEDS-HOUR FEEDS-STOP switch to the STOP position.

(3) Remove the crank from the retaining clip on the right-hand side of the wind speed spring chart drive. Connect the crank to the crankshaft located on the motor gear housing just below the crank retaining clip. Push in on the crank and turn it in a clockwise direction to wind the motor spring. It takes aprpoximately 55 turns to fully wind the motor spring.

(4) Follow the directions in (3) above for the wind direction chart drive.

(5) Install the two red change gears on the change gear drive shafts (par. 25*b*) on both spring chart drives.

(6) Set the MIN. FEEDS-HOUR FEEDS-STOP switch to the MIN. FEEDS position.

(7) Check to see that the chart feeds at exactly 6 inches per minute on both spring chart drives.

Note. The numbers in the left-hand margin of the charts are spaced at 6-inch intervals (figs. 25 and 26).

(8) If the chart feed timing is not correct, adjust the HR. FEED ADJ control (fig. 20) until the charts feed at exactly 6 inches per minute.

(9) Set the MIN. FEEDS-HOUR FEEDS-STOP switch to the HOUR FEEDS position. Check to see that the charts slow down so that their movement is just visible.

(10) Turn the MIN. FEEDS-HOUR FEEDS-STOP switch to the STOP position and reinstall the original set of change gears that were replaced by the red change gears ((5) above).

(11) Do not replace the covers until the recorders have been adjusted (*c* and *d* below).

c. Adjusting Wind Direction Recorder. Adjust the wind direction recorder for proper chart indications as follows:

(1) Remove the housing from the amplifier-power supply by loosening the retaining screw in the top of the rear panel and sliding the panel-chassis assembly out of the front of the housing.

(2) Remove both covers from the recorders.

(3) Set the ON-OFF switch on the amplifier-power supply to the ON position, on the amplifier-power supply, and allow the equipment to warm up for 5 minutes.

(4) If the synchronous chart drives are being used, set the ON-OFF switch on both chart drives to ON and the HOUR FEEDS-MIN. FEEDS switch to MIN. FEEDS (fig. 19). If the spring chart drives are being used, set the MIN. FEEDS-HOUR FEEDS-STOP switch to MIN. FEEDS (fig. 20).

(5) Hold the W.D. RCDR ZERO switch (fig. 11) forward; the pen element in the wind direction recorder should be positioned directly on the far left-hand line of the chart roll. This is equivalent to a zero position.

(6) If the pen element is not directly over the left-hand line, adjust the zero adjustment, located in the bottom of the recorder case (fig. 15) until the pen is positioned over the left-hand line. Hold the W.D. RCDR ZERO switch (fig. 11) forward while making this adjustment.

(7) Hold the W.D. RCDR FULL SCALE switch (fig. 11) forward. The pen element in the wind direction recorder should swing to the right and rest on the extreme right-hand line of the chart.

(8) If the pen element does not swing to the extreme right, adjust the FULL SCALE ADJ control (fig. 11) until the pen element is positioned over the extreme right-hand line of the chart. Hold the W.D. RCDR FULL SCALE switch forward while making this adjustment.

Note. After adjusting the control release the W.D. RCDR FULL SCALE switch and lock the position of the FULL SCALE ADJ control by tightening the locking nut of the control.

(9) Turn the wind vane on the wind direction detector so that the mark on the bottom of the wind vane lines up exactly with the mark on the rotating head of the drive shaft. The pen element should swing over the exact center line of the wind direction recorder chart.

(10) Rotate the wind vane approximately 180° to the right and 180° to the left. Fill the inkwell (par. 27*a*) and check to see that the pen element marks the chart from one extreme line on the chart to the opposite extreme line (fig. 26).

(11) Slide the amplifier-power supply panel-chassis assembly back into the housing and tighten the retaining screw in the rear panel. Do not replace the covers on the recorder until the wind speed recorder has been adjusted (*d* below).

d. Adjusting Wind Speed Recorder. Adjust the wind speed recorder as follows:

(1) Adjust the wind direction recorder (*c* above).

(2) Turn the amplifier-power supply off. Turn the wind speed chart drive on, and adjust the zero adjustment (fig. 15) until the pen element is positioned on the extreme left-hand chart line (zero).

(3) Hold the wind speed detector housing firmly with one hand and unscrew the lamp housing (fig. 10). Use an open-end wrench to loosen the lamp housing if necessary. Be very careful not to damage the detector. Remove the exciter lamp; replace the lamp housing, turn it fingertight.

(4) If the synchronous chart drives are being used, set the ON-OFF switch on both chart drives to the ON position (fig. 19). Set the HOUR FEEDS-MIN. FEEDS switch to the MIN. FEEDS position. If the spring chart drives are being used, set the MIN. FEEDS-HOUR FEEDS-STOP switch to the MIN. FEEDS position (fig. 20).

(5) Set the ON-OFF switch on the amplifier-power supply to the ON position. Set the MAX. RANGE MPH switch to 60 (fig. 18). The pen element in the wind speed recorder should swing over to a chart reading of .5 miles per hour.

(6) Replace the exciter lamp in the lamp housing in the wind speed detector housing.

(7) Carefully rotate the anemometer on the wind speed detector by hand. Note that the pen element in the wind speed recorder deflects to the right and records the rotation on the chart.

Caution: Rotate the anemometer carefully by hand. Do not spin the anemometer by hand as serious damage to the bearings will result.

(8) Check and adjust the pen elements (*e* below) before replacing the covers on the recorder.

e. Checking and Adjusting Pen Elements. Check and adjust the pen point pressure as follows:

(1) Turn the ON-OFF switch of the amplifier-power supply to ON.

(2) Operate the chart drives (pars. 28–30).

(3) Set the MAX. RANGE MPH switch on the amplifier-power supply to 6 (fig. 18).

(4) Slowly rotate the anemometer. The pen point in the wind speed recorder should leave an even line across the chart. If the line tends to fade off at full scale, unscrew the pen weights (fig. 21) and adjust for more pressure on the pen point. If the line tends to be heavy and blurry, adjust the pen weight for less pen point pressure. Screw the weights on the pen element.

(5) Turn the wind vane 180° to the right and 180° to the left; the pen point in the wind direction recorder should leave an even line across the chart. If the line tends to fade off at either end, unscrew the pen weights and adjust the pen element for more pressure on the pen point. If the line tends to be heavy and blurry, adjust the pen weight for less pen point pressure. Screw the weights on the pen element.

f. Checking External Chart Drive Motor. Check the operation of the external chart drive motor as follows:

(1) Remove both covers from the recorder.

(2) Install the small gold change gear on the lower change gear shaft and the large gold change gear on the upper change gear shaft (par. 25*b*).

(3) Set the ON-OFF switches on both chart drives (fig. 19) and the external drive chart motor to the ON position. If an external chart drive motor switch has been installed (par. 19*c*), set that switch to the ON position.

(4) Check to see that the chart drive feeds 12 inches in exactly 9 seconds using a stop watch.

(5) Replace the original change gears that were replaced with the gold change gears ((2) above).

g. Checking Chrono Pen Operations.

(1) Check the chrono pens by momentarily holding and then releasing the external chrono pen switch (par. 19*b*).

(2) Check to see that the chrono pens mark the right-hand margin of both charts.

(3) Turn off the chart drives and the external chart speed motor. Replace the covers on the recorder.

(4) Turn the ON-OFF switch on the amplifier-power supply to OFF.

h. Checking Hose Assembly and Reducing Valve. Open the valve on the top of the nitrogen tank and adjust the handle of the reducing valve for a reading

of 30 on the output pressure gage (fig. 10). If a 210- to 225-cubic foot nitrogen tank is used, the tank pressure gage should read 210 to 225 cubic feet at 70° C. The tank pressure gage will read a little less than rated tank capacity if the temperature is less than 70° C. and a little more if the temperature is above 70° C. Check for leaks around all fittings in the hose assembly and the reducing valve, and eliminate leaks by applying soap to the connectors.

CHAPTER 3

OPERATION

Section I. CONTROLS AND THEIR USES

21. Controls and Instruments

The chart below lists the controls and instruments used on the equipment. Do not attempt to operate the equipment until the use of the controls and instruments is understood fully.

a. Amplifier-power Supply.

Control or instrument	Function
Cable impedance switch (fig. 12)	Three-position rotary switch: Adjusts for various lengths of cord between wind speed detector and amplifier-power supply.
MAX. RANGE MPH switch (fig. 18)	Four-position rotary switch: Selects scale recorder readings at wind speed of 6, 12, 30, or 60 miles per hour
W.D. RCDR ZERO switch (fig. 11)	Momentary-action toggle switch: Sets wind direction amplifier circuit at minimum output during adjustment of zero adjustment in wind direction recorder (fig. 15).
W.D. RCDR FULL SCALE switch	Momentary-action toggle switch: Sets output from wind direction detector at maximum when adjusting zero adjustment, in wind direction recorder, for FULL SCALE ADJ in amplifier-power supply.
FULL SCALE ADJ control	Variable resistor: Adjusts output of wind direction detector for full scale recorder indication.
ON-OFF switch (fig. 18)	SPST toggle switch: Connects amplifier-power supply to ac power source.
Dial lamp	Glass jewel: Indicates when ac power is applied to the amplifier-power supply

b. Recorder.

Control or instrument	Function
ZERO ADJUSTMENT (wind speed) (fig. 15).	Lever adjustment: Adjusts the pen elements in wind speed recorder for a zero indication.
ZERO ADJUSTMENT (wind direction)	Lever adjustment: Adjusts the pen element in the wind direction recorder for an extreme right-hand indication on chart.
ON-OFF switch (wind speed synchronous chart drive) (fig. 19).	SPST toggle switch: Connects ac power to synchronous chart drive motor and reroll motor.
ON-OFF switch (wind direction synchronous chart drive).	SPST toggle switch: Connects ac power to synchronous chart drive reroll motor.
ON-OFF switch (external chart drive motor).	SPST toggle switch: Connects ac power to motor.
HOUR FEEDS-MIN. FEEDS switch (wind speed synchronous chart drive) (fig. 19).	Lever switch: Changes the speed at which the chart is drawn under the pen.

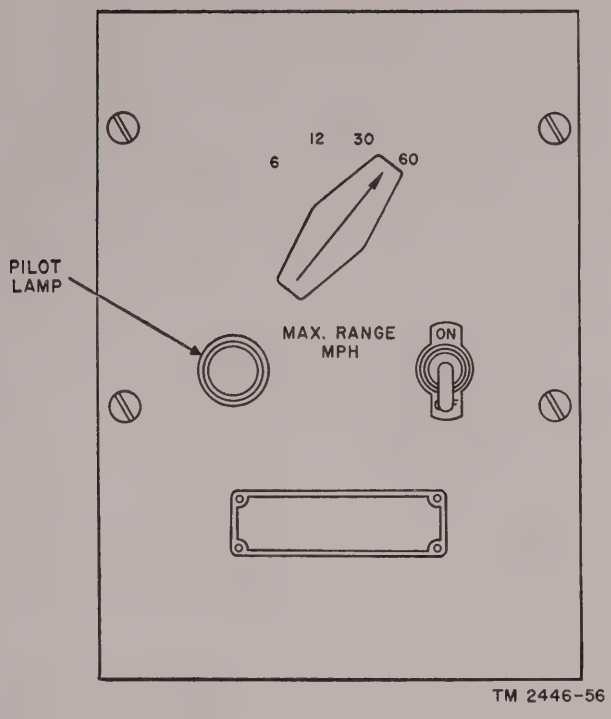


Figure 18. Amplifier-power supply, front panel.

b. Recorder—Continued

Control or instrument	Function
MIN. FEEDS-HOUR FEEDS-STOP switch (wind speed spring chart drive) (fig. 20).	Lever switch: Starts and stops spring motor and changes the motor speed applied to the chart drive roller.
HR FEEDS ADJ control	Lever switch: Provides linear speed of spring chart drive.
Pen element	Recording pen: Applies inked lines to the chart when the recorders are operating.
Chrono pen	Recording pen: Indicates time intervals during operation. Usually operated by an external switch.
S-F adjustment control (wind speed spring chart drive (fig. 20).	Screw adjustment: Provides linear speed adjustment of spring chart drive (MIN. FEEDS).

c. Reducing Valve (fig. 10).

Control or instrument	Function
Handle	Butterfly handle: Adjust nitrogen pressure applied to hose assembly.
Hose pressure gage	Indicating dial: Indicates nitrogen pressure being applied to hose assembly.
Tank pressure gage	Indicating dial: Indicates pressure in nitrogen tank.

d. Vibrator-inverter.

Control or instrument	Function
ON-OFF switch (front of vibrator-inverter).	Spst toggle switch: Connects the negative terminal of the 6-volt battery to the vibrator circuit.
Dial lamp (front of vibrator-inverter).	Indicator lamp: Indicates ac power is being supplied to the output connector.

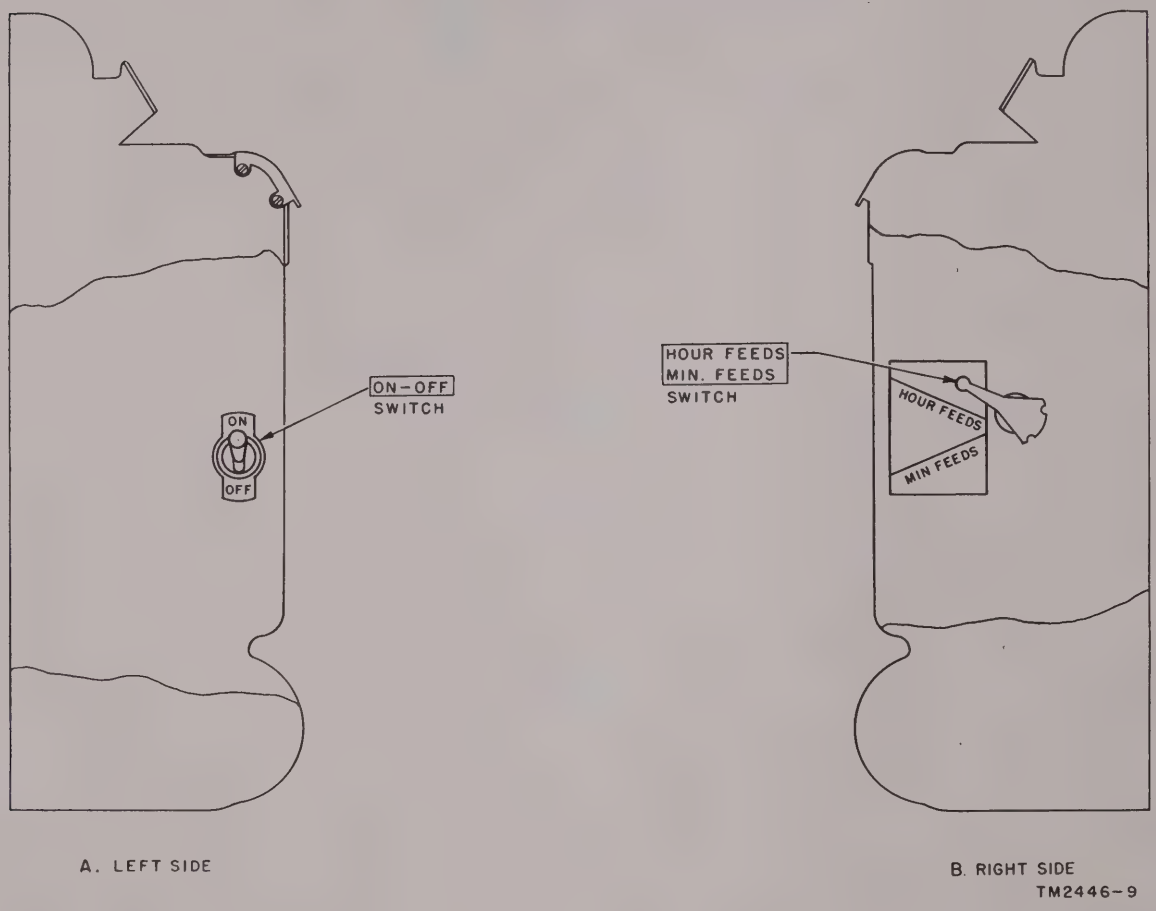


Figure 19. Location of controls, synchronous chart drives.

22. Precautions When Handling Equipment

Use normal precautions for the protection of the delicate instruments when handling the equipment. Be very careful when servicing the interior of the equipment. The supply voltage is present on many terminal connections.

a. Do not remove the wind speed or wind direction detectors for any purpose, until the plug is screwed into the bottom of the tubular rod. Protect the hose assembly from dirt and moisture.

b. Do not place the wind speed or wind direction detectors where they may be subject to dirt or sediment.

c. Do not move the sighting bar on the wind direction detector tubular rod.

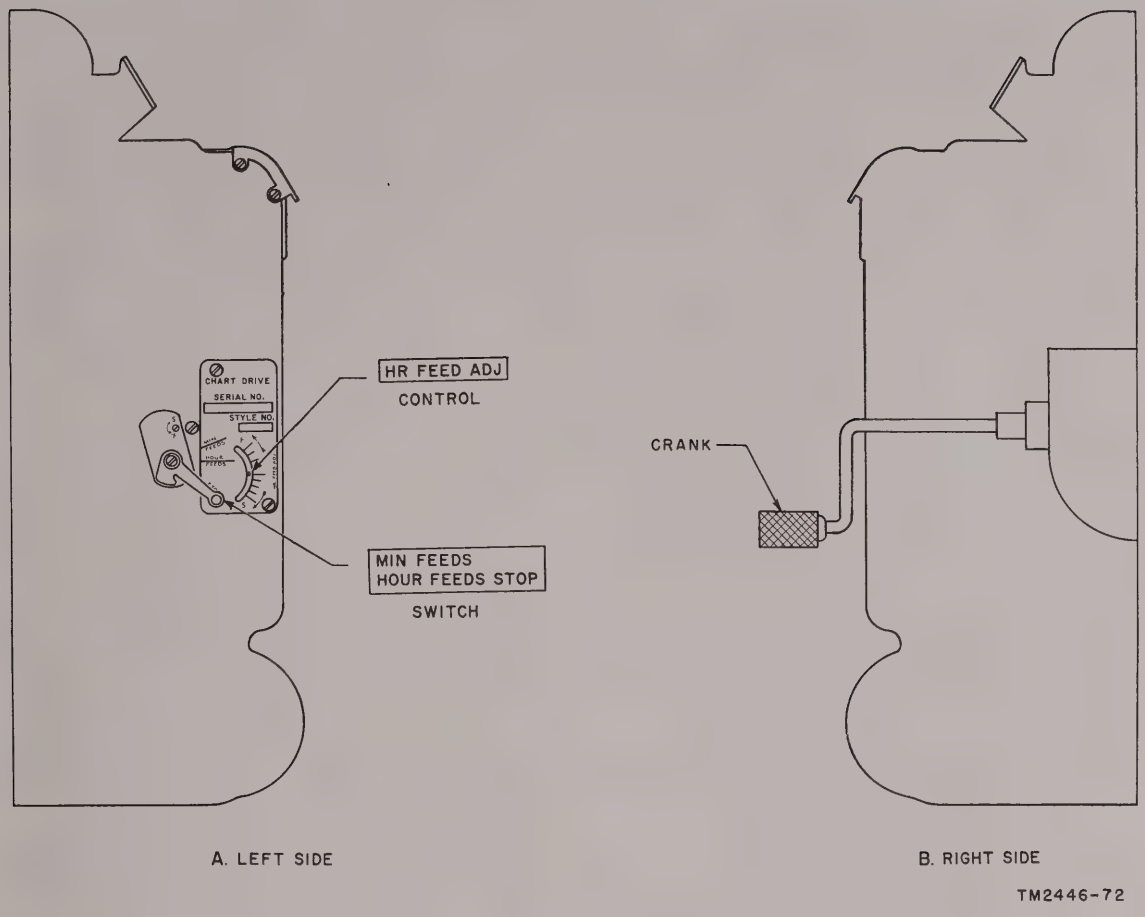


Figure 20. Location of controls, spring chart drives.

Section II. PRELIMINARY OPERATING PROCEDURES

23. General

a. Types of Chart Drives. The wind measuring set is normally transported with synchronous chart drives installed in the recorder and spring chart drives mounted on a mounting board (fig. 2). If 110- to 125-volt ac, 60-cycle power is available, use the synchronous chart drives. If ac power is not available, use the spring chart drives. The chart drives can be identified as follows:

Type of chart drives	Identification No.	Location of name plate
Wind speed synchronous chart drive.	90 MS	Right-hand side of chart drive chassis.
Wind direction synchronous chart drive.	91 P	Right-hand side of chart drive chassis.
Wind speed spring chart drive.	80 M	Left-hand side of chart drive chassis.
Wind direction spring chart drive.	81 P	Left-hand side of chart drive chassis.

b. Use of Chart Drives.

(1) For ac operation using synchronous chart drives, refer to paragraph 28.

(2) For ac operation using external chart drive motor, refer to paragraph 29.

(3) For dc operation using spring chart drives, refer to paragraph 30.

24. Installation of Chart Drives

a. Spring Chart Drives (Dc Operation). Install the spring chart drives as follows:

(1) Turn the cover latch (fig. 21) of the wind direction recorder to the right and swing the cover open about 3 inches.

(2) Slide the lower end of the cover in toward the recorder case approximately one-fourth of an inch and lift the cover free from the hinges.

(3) Lift out the chart pen holder card with the attached pen element (fig. 21).

(4) Tilt the scale back, grasp the chrono pen near the pen point, and lift it straight up out of the hole in the relay bracket.

(5) Grasp the two wire handles on the front of the inkwell and lift the inkwell up and out of the case (fig. 24).

(6) Loosen the adjusting screw in the relay bracket with an open-end wrench, and swing the relay bracket to the left approximately one-fourth of an inch.

(7) Slide the chart coupler (fig. 15) between the two chart drives to the right or left as required. Loosen the captive screw in each corner of the chart drive. Grasp both sides of the chart drive and pull it straight out of the case.

(8) Slide the chart coupler off of the wind speed chart drive shaft.

(9) Repeat (1) through (7) above for the chart drive of the wind speed recorder.

(10) Loosen the captive screw in each corner of the wind direction spring chart drive, and remove the chart drive from the mounting board (fig. 2).

(11) Insert the wind direction spring chart drive into the left-hand (wind direction) recorder case and tighten the captive screws.

(12) Slide the chart coupler through the hole in the left-hand side of the wind speed recorder case and over the end of the drive shaft. Make certain that the pins of the shaft are seated in the slots of the chart coupler. Push it on the shaft as far as possible.

(13) Remove the wind speed spring chart drive from the mounting board (fig. 2).

(14) Insert the wind speed spring chart drive into the right-hand recorder (wind speed) case and tighten the captive screws. Rotate the chart coupler with the fingers until the slots in the chart coupler line up with the pin protruding from each end of the drive shaft on the wind speed chart drive. Slide the chart coupler onto shaft approximately one-fourth of an inch.

(15) Do not install the inkwells, pen elements, or chrono pens until they have been filled with ink and until the chart rolls have been installed (pars. 26 and 27).

(16) Spring the ends of the scale of the wind direction synchronous chart drive toward each other and lift it out of the chart drive. Insert the scale in the wind direction spring chart drive, and swing it up.

(17) Spring the ends of the scale of the wind speed synchronous chart drive toward each other and lift it out of the chart drive. Insert the scale in the wind speed spring chart drive, and swing it up.

(18) Install the charts before replacing the covers (par. 26).

(19) Attach the synchronous chart drives to the mounting board and place the mounting board in carrying case No. 4 (figs. 2 and 3).

b. Synchronous Chart Drives (Ac Operation). Install the synchronous chart drives in the same manner as the spring chart drives (*a* above).

c. External Chart Drive Motor (Ac Operation). To install external chart drive motor for high speed recording, proceed as follows:

(1) Check to see that the change gears are arranged for a chart speed of ¾, 1½, or 3 inches per second (par. 25*a*).

(2) Install the external chart drive motor (par. 18*b*).

(3) If the external chart drive motor switch has been installed (par. 19*c*), set the switch to the OFF position.

(4) If the external chart drive motor switch has not been installed, check to see that the shorting plug (fig. 2) is inserted in the WS-WD CHART FEEDS connector J403 on the wind speed recorder (fig. 14 and 16).

25. Selection and Installation of Change Gears

a. Types of Change Gears. There are three sets of change gears for changing the rate of chart feed in each chart drive. The three sets are used to obtain any one of five rates of chart feed. One set of change gears is installed on the left-hand side of each chart drive (fig. 21) before operation. Each set of change gears is a different color. Use the following chart to determine the gears that must be used to obtain the indicated chart feed speeds.

Color of change gear	Installation	Chart speed
Gold	Large gold gear on upper shaft, small gold gear on lower shaft.	¾ inches per hour, minute, or second.
	Small gold gear on upper shaft, large gold gear on lower shaft.	12 inches per hour, or minute.
Green	Large green gear on upper shaft, small green gear on lower shaft.	1½ inches per hour, minute, or second.
	Small green gear on upper shaft, large green gear on lower shaft.	6 inches per hour, or minute.
Red	One red gear on each shaft (the gears are the same size).	3 inches per hour, minute, or second.

(1) Each gear is held in place by a knurled nut. The remaining two sets of change gears are mounted on a gear clip and secured with a knurled nut. The gear clip is held by a bracket on the top left-hand side of each chart drive (fig. 21).

(2) Any set of gears may be used with spring chart drives (dc operation) or with the synchronous chart drives (ac operation). However, if the external chart drive meter is to be operated (ac operation), use only a ¾, 1½, or 3-inch change gear arrangement.

b. Installing Change Gears (fig. 15). Install change gears in each recorder as follows:

(1) Unscrew the knurled nut that attaches each change gear to its shaft. (If the nuts are too tight, hold the gears with the eraser end of a pencil at the point where the gears mesh and loosen the knurled nuts with a pair of long-nosed pliers.)

(2) Remove the gear clip by sliding it up and out of its bracket.

(3) Remove the knurled nut from the gear clip and withdraw the change gears to be installed (*a* above).

(4) Place the remaining change gears on the gear clip and screw on the knurled nut. Slide the gear clip back into its mounting bracket on the chart drive.

(5) Place a change gear on each change gear shaft, as determined in *a* above, with the slotted side of the bushing on the inside.

(6) Seat the bushing slot over the projections on the change gear shaft.

(7) Screw on the knurled nuts and finger tighten.

26. Installation of Charts

(figs. 21 and 22)

a. Install a chart in each recorder as follows:

(1) Remove the reroll roller (fig. 21) located in the bottom of the chart drive by releasing the catch on each end and lifting the roller straight out of the chart drive.

(2) The chart supply arbor is held in place by spring pressure. Lift the chart supply arbor up and pull forward to remove.

(3) Remove the chart from its box and insert the chart supply arbor through the core of the chart.

(4) Replace the chart supply arbor in the chart drive with the elongated perforations on the chart at the right-hand end of the arbor.

(5) Check to see that the chart turns freely.

(6) Tear or cut the end of the chart paper to a V-shape and feed the chart into the slot on the face of the chart drive designated INSERT END OF CHART HERE. Keep feeding the chart into the slot until the chart end hangs over the drive roller.

(7) Turn the set knob on the right-hand end of the drive roller until the drive roller sprocket pins engage the chart perforations (fig. 22).

(8) Snap the reroll roller into place with the gear end on the left.

(9) Insert the V-end of the chart into the slot in the reroll roller and crease. Turn the reroll roller back approximately one-fourth of a turn to release reroll.

(10) Turn the set knob on the chart drive roller forward with the right hand, while allowing the reroll roller to turn forward slowly in the left hand. Be sure that the chart rolls smoothly on the reroll roller.

Note. The chart drive must be turned on to turn the reroll roller of the synchronous chart drives.

b. Do not replace the cover (fig. 21) until the inkwell and pen element have been filled (par. 27).

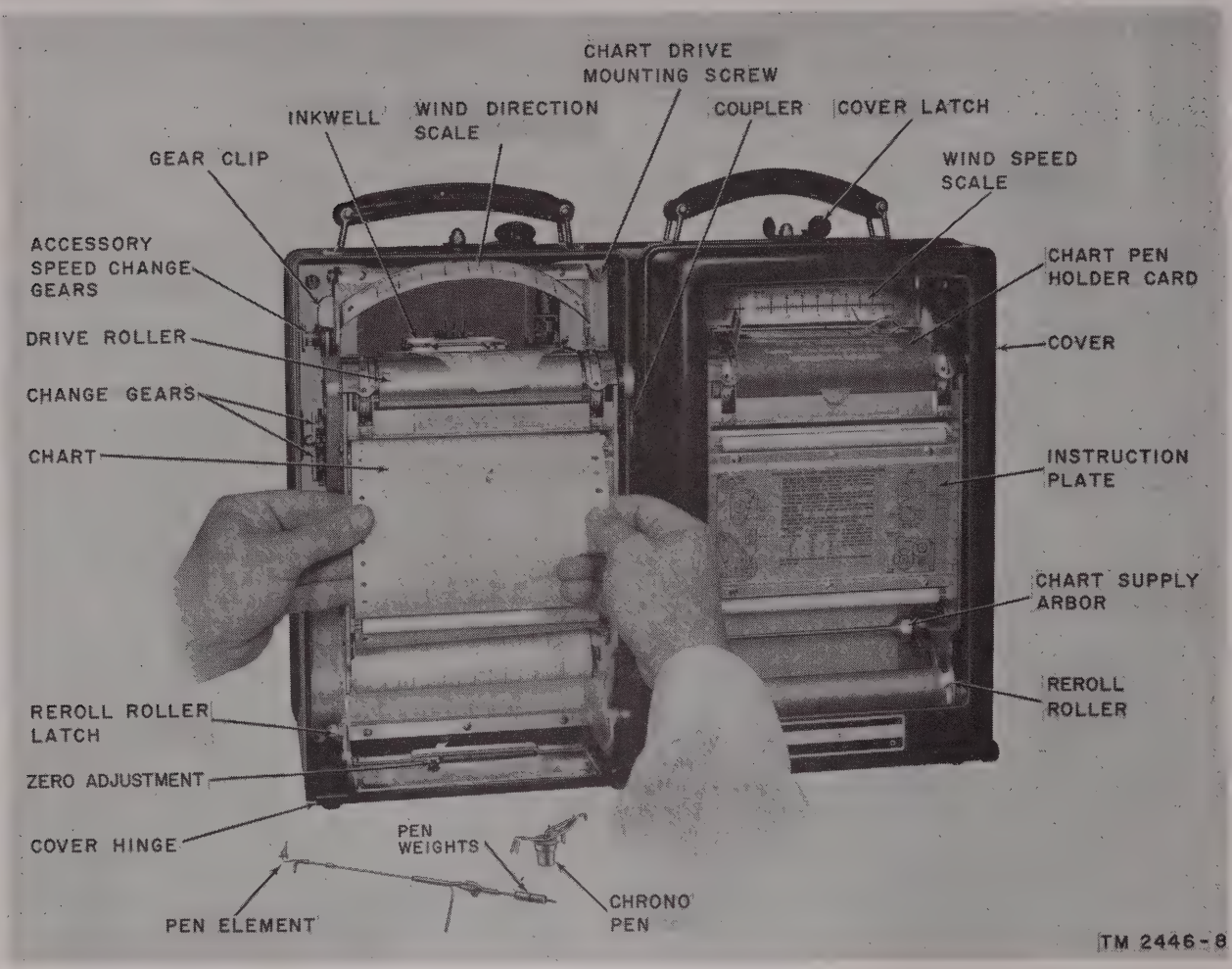


Figure 21. Installing chart in recorder.

27. Filling and Adjusting Pens

(figs. 23 and 24)

a. Filling and Installing Inkwell and Pen Element.

(1) Fill the inkwell with ink to about one-eighth of an inch from the top with the eye dropper inkwell filler (fig. 23).

(2) Hold the inkwell by the wire handles and insert it in the top center of the recorder case (fig. 24) by pushing the inkwell under the inkwell holder prongs.

(3) Replace the pen element in the fork in the top center of the recorder case. The vertical spout just forward of the mounting pin should be sticking down into the inkwell.

(4) Turn the pen weights, on the rear of the pen (fig. 21), forward or backward until the pen element balances freely and the pen point is off the chart.

(5) Compress the bulb of the pen filler and insert the tip end over the pen element point. Release the pressure on the bulb until ink appears at the pen point.

(6) Turn the chart ahead (fig. 22) until the pen point lines up with one of the time marking numbers on the left-hand border of the chart.

(7) Turn the pen weights, forward or backward, until the pen point just marks the chart.

(8) Swing the pen across the chart to insure that it is inking properly.

b. Filling and Adjusting Chrono Pen.

(1) Unscrew the knurled inkwell on the chrono pen (fig. 21).

(2) Fill the pen with ink with the eye dropper inkwell filler, and screw the inkwell back in place.

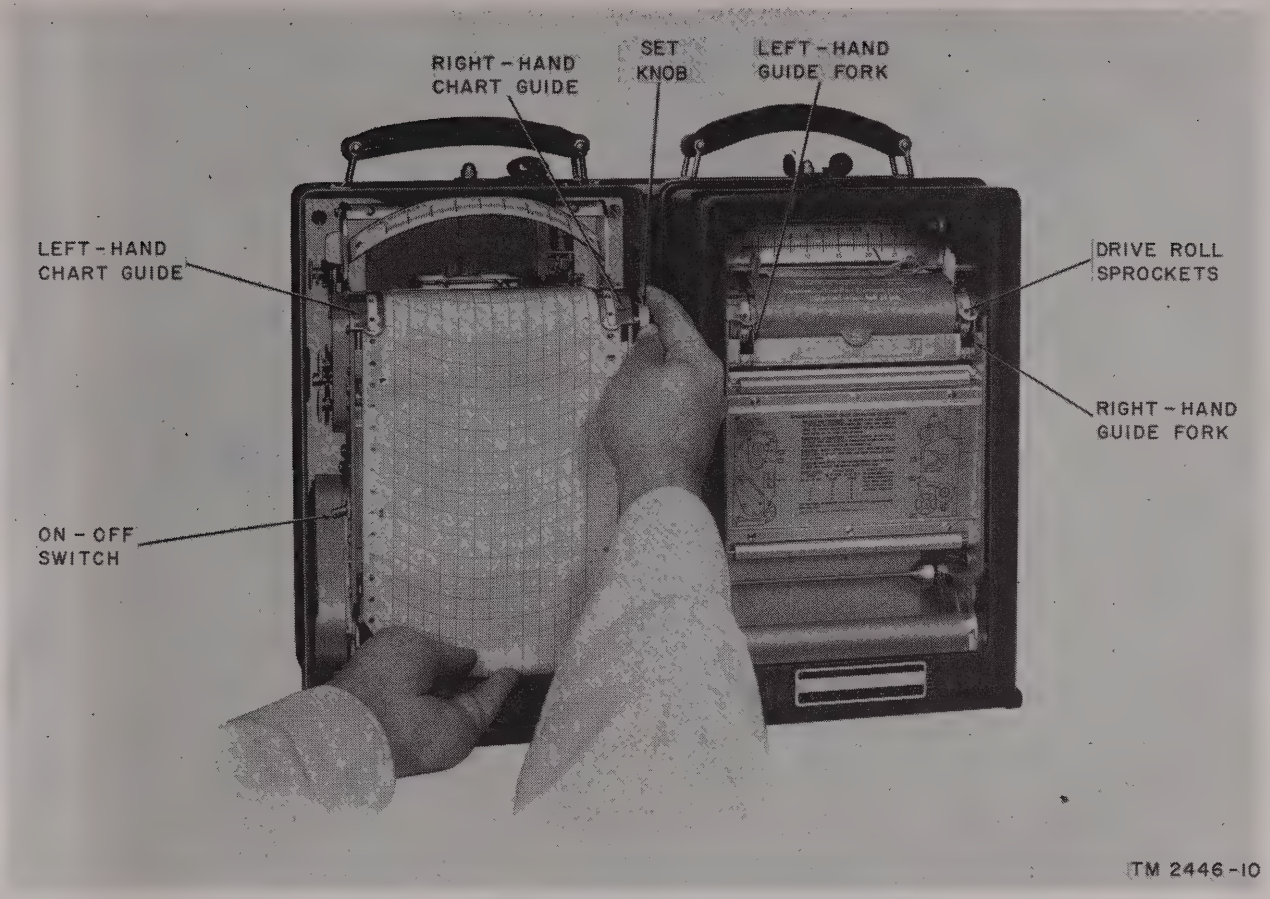


Figure 22. Attaching chart to reroll roller.

(3) Compress the bulb of the pen filler and insert the chrono pen tip into the tip of the bulb. Release pressure on the bulb until ink appears at the pen tip.

Note. Be careful not to remove too much ink from the inkwell. Be sure that no air bubble is present in the pen or pen tube, because the pen will cease to write when the bubble reaches the pen point.

(4) Carefully place the chrono pen back into its retaining bracket.

(5) Check to see that the forked tail of the inkwell engages the lever arm of the relay arm located directly behind it in the case.

(6) Check to see that the chrono pen writes, by pushing the relay lever (not shown) back and forth with a pencil. The pen should write with a stroke of approximately 1/10 inch in an area approximately $\frac{3}{32}$ inch from the edge of the graph on the chart.

(7) If the chrono pen does not write in the proper area of the chart, loosen the hexagonal head screw located on the left just behind the chrono pen inkwell. Slide the bracket to the right or left as required and tighten the hexagonal head screw.

(8) Swing the pen element (recording pen) to form a line to the extreme right on the chart. The line formed by the chrono pen ((6) above) should be in line with the line formed by the pen element.

(9) If the ink lines are not in proper alinement, remove the chrono pen and loosen the two hexagonal head screws (not shown) that attach the relay to the top of the meter movement. Slide the relay forward or backward, enough to compensate for the error, and tighten the attaching screws. Replace the chrono pen.

(10) Replace the covers on the recorder cases.

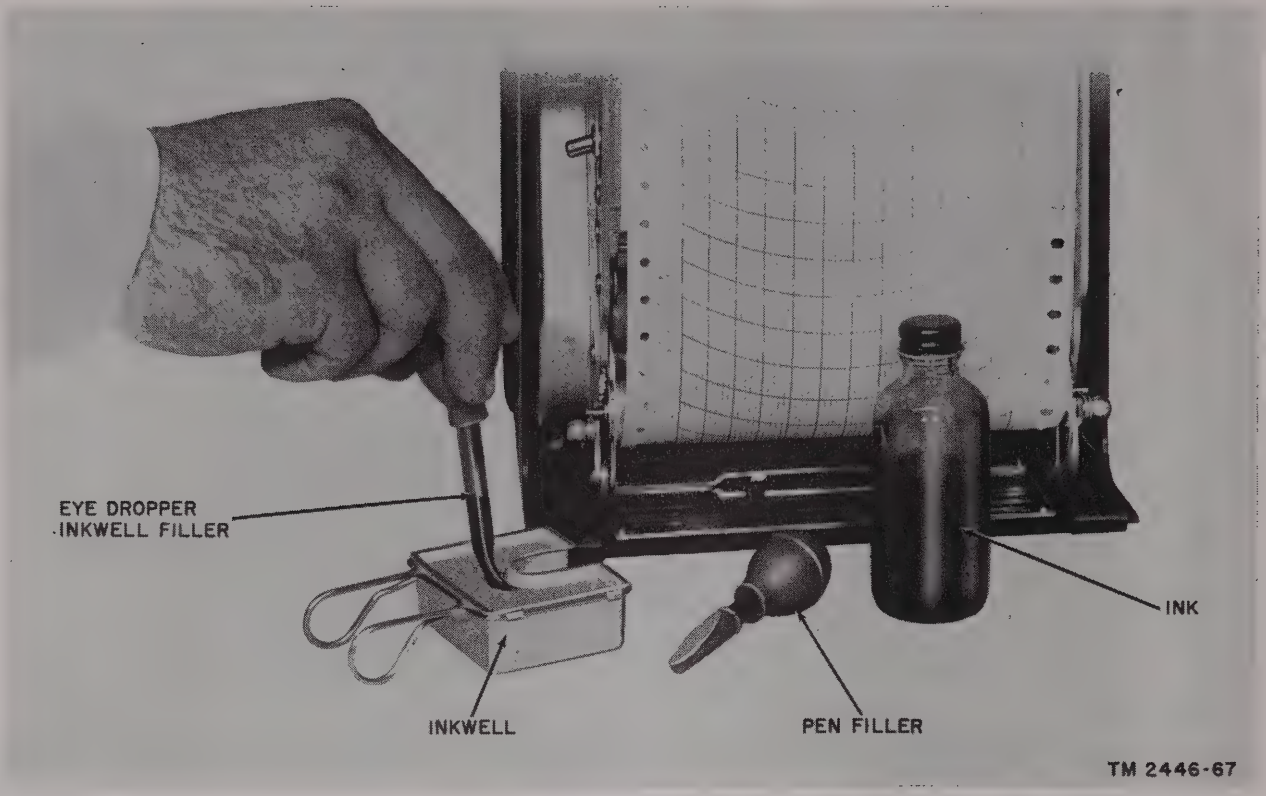


Figure 23. Filling inkwell.

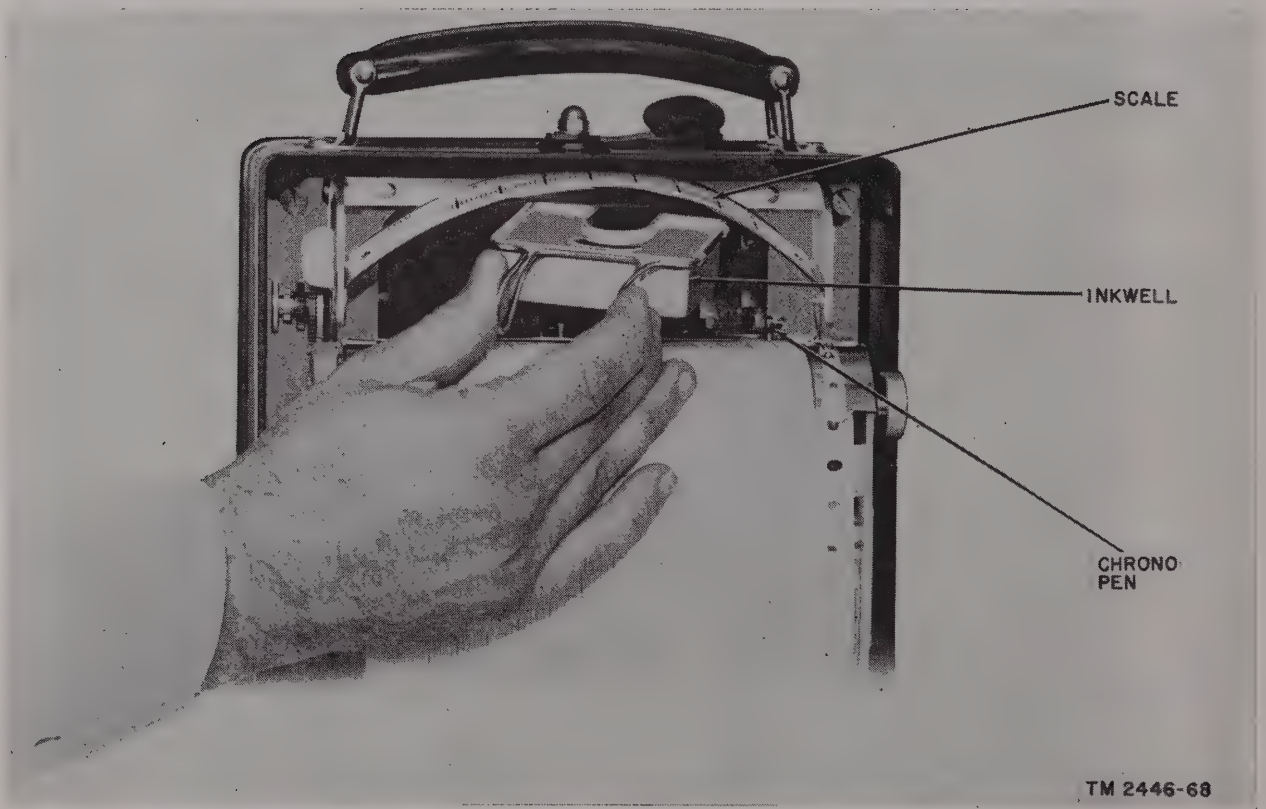


Figure 24. Installing inkwell.

Section III. OPERATION UNDER USUAL CONDITIONS

28. Ac Operation, Synchronous Chart Drives

a. Starting Procedure.

(1) Remove the covers from the recorder. Check to see that the proper change gears are installed for the desired per-inch-chart feed (par. 25*b*).

(2) Install the wind speed and wind direction charts (par. 26).

(3) Set the HOUR FEEDS-MIN. FEEDS switch on the wind speed synchronous chart drive (fig. 19) to the desired chart speed.

(4) If an external chart drive motor switch has been installed (par. 19*c*), set the HOUR FEEDS-MIN. FEEDS switch to HOUR FEEDS (par. 20*a*). If there are no external switches, insert the shorting plug in the wind speed recorder (par. 24*c*).

(5) Fill the inkwell and adjust the pen elements (par. 27*a*).

(6) Fill and adjust chrono pens (par. 27*b*).

(7) Check the adjustment of the reducing valve (par. 20*h*).

(8) Turn the ON-OFF switch on the amplifier-power supply to ON (fig. 19). The pilot lamp will glow.

Note. Allow the set to warm up for at least 5 minutes.

(9) Set the ON-OFF switches on both chart drives to ON (fig. 19). Both charts will move.

(10) Check to see that the charts feed onto the reroll rollers and that the pen elements leave clean ink lines on the charts.

(11) Turn the MAX. RANGE MPH switch (fig. 18) so that the ink line is drawn over approximately ¾ of the chart width.

Note. If the recorder is left unattended set the MAX. RANGE MPH switch to 60.

(12) Replace the covers on the recorder.

(13) Momentarily close the external chrono pen switch and record the starting time.

Note. Each time the chart drives are stopped or the chart drive speed is changed, momentarily close the external chrono pen switch and record the time. Closing the switch leaves a mark in the right-hand margins of each chart and is used for evaluating the chart recordings (pars. 32 and 33).

(14) Operate the recorder for at least 1 hour to be sure that the equipment is operating properly.

b. Stopping Procedure.

(1) Momentarily press the external chrono switch and record the time.

(2) Turn the ON-OFF switch on the amplifier-power supply to OFF (fig. 18).

(3) Open the covers on the recorder and turn the ON-OFF switch on each chart drive to OFF (fig. 19).

(4) If the wind measuring set is not to be operated again within a 2-hour period, remove and thoroughly wash the pen elements, inkwells, and chrono pens. Clean the pen elements by placing the tip of the filler bulb over the pen point and drawing 2 or 3 ounces of clean water through the pen element.

Note. DO NOT turn off the nitrogen if the set is to remain installed. The nitrogen is necessary to keep moisture and dirt out of the detectors.

(5) Replace the inkwells, pen elements, and chrono pens and close the covers on the recorder.

29. Ac Operation, External Chart Drive

The external chart drive motor is used to increase the chart speed to ¾, 1½, or 3 inches per second for measuring a wind disturbance of short duration.

a. Starting Procedure.

(1) Follow the procedure in pargraph 28*a*(1) through (10).

(2) If external switches are connected, and it is desired to record wind speed and wind direction in inches per second, set the HOUR FEEDS-MIN. FEEDS switch to HOUR FEEDS (fig. 19) and close the external chart drive motor switch (fig. 17) if installed.

(3) If an external chart drive motor switch has not been installed, insert the shorting plug (par. 24*c*), turn the ON-OFF switch (on the external chart drive motor) to ON to record information in inches per second speed.

(4) Follow the procedure in paragraph 28*a*(11) through (14).

b. Stopping Procedure.

(1) Momentarily press the external chrono switch and record the time.

(2) If external switches are connected, open the external chart drive motor switch.

(3) If external switches have not been installed, turn the ON-OFF switch on the external chart drive motor to OFF.

(4) Follow the procedure in paragraph 28*b*(2) through (5).

30. Dc Operation, Spring Chart Drives

a. General. Before starting the equipment, proceed as follows:

(1) Remove the covers from the recorders. Check to see that the desired change gears are installed on the chart drives (par. 25*a*).

(2) Remove the crank (fig. 20) from the clip on the right-hand side of either spring chart drive.

(3) Insert the spare end of the crank into the square-crank-shaft hole on the right-hand side of the wind speed spring chart drive.

(4) Press in on the crank and turn in a clockwise direction to wind up the spring motor. Approximately 55 turns of the crank are required. Refer to paragraph 7 for running time.

(5) Wind up the wind direction spring chart drive as described in (2) through (4) above.

(6) Install the wind speed and wind direction charts (par. 26).

(7) Fill the inkwell and adjust the pen elements (par. 27*a*).

(8) Fill and adjust the chrono pens (par. 27*b*).

(9) Check the adjustment of the reducing valve (par. 20*h*).

b. Starting Procedure. With the spring chart drives installed (par. 24*a*) in the recorder, proceed as follows:

(1) Turn the vibrator-inverter ON-OFF switch to ON.

(2) Turn the amplifier-power supply ON-OFF switch to ON.

Note. Allow the unit to warm up for approximately 5 minutes.

(3) Set the MIN. FEEDS-HOUR FEEDS-STOP switch (fig. 20) on the wind speed chart drive to the desired chart speed and close the covers on the recorder.

(4) Turn the MAX. RANGE MPH switch (fig. 18) so that the ink line is drawn over approximately ¾ of the chart width.

Note. If the recorder is left unattended set the MAX. RANGE MPH switch to 60.

(5) Momentarily press the external chrono switch to record the start time.

(6) Observe the operation of the recorder for at least 1 hour to be sure that the equipment is operating properly.

(7) Arrange the chart drives to operate at 6 inches per hour for general recording of wind information.

(8) For recording other than general wind information, change the chart speed as follows:

(*a*) Change the gear combination (par. 25*b*).

(*b*) Position the MIN. FEEDS - HOUR FEEDS-STOP switch (fig. 20) as required.

c. Stopping Procedure.

(1) Momentarily press the external chrono pen switch to record the stopping time.

(2) Turn the ON-OFF switch on the amplifier-power supply to OFF (fig. 18).

(3) Turn the ON-OFF switch on the vibrator-inverter to OFF.

(4) Open the covers on the recorder and set the MIN. FEEDS-HOUR FEEDS-STOP switch to STOP (fig. 20).

(5) If the wind measuring set is not to be operated again within a 2 hour period, remove and thoroughly wash the pen elements, inkwells, and chrono pens.

(6) Replace the inkwells, pen elements, and chrono pens and close the covers on the recorder.

Note. DO NOT turn off the nitrogen if the wind measuring set is to remain installed in the field.

31. Removing Used Chart Sections

Sections of the charts may be removed without stopping the chart drives, except when the external chart drive motor is operating. Remove the sections of the chart as instructed below.

Note. If the external chart drive motor is operating, remove power from the motor by one of the following

methods: open the external chart drive motor switch; remove the shorting plug, or turn the ON-OFF switch on the external chart drive motor to OFF.

a. Open the covers on the recorders.

b. Release the latches on each end of the reroll roller (fig. 21) and lift out the roller.

c. Tear off the used chart section from the reroll roller.

d. Replace the end of the chart roll in the recorder (par. 26).

e. Close the covers on the recorders.

32. Interpreting Wind Speed Chart Recordings

(fig. 25)

The wind speed (*a* below) and the time interval (*b* below) of any given wind condition can be determined from the information on the wind speed chart.

a. The wind speed chart has four scales marked on it at approximately 8-inch intervals. The scale to be used depends upon the setting of the MAX. RANGE MPH switch. With the MAX. RANGE MPH switch in the 6 position, use the 0 to 6 scale; in the 12 position use the 0 to 12 scale; in the 30 position use the 0 to 30 scale; and in the 60 position use the 0 to 60 scale. The values of the subdivisions (vertical lines) for each scale are given in the following chart.

Setting of MAX. RANGE MPH switch (fig. 18)	Vertical line equivalents in mph (fig. 25)	
	Heavy lines	Light lines
6	.5	.1
12	1.0	.24
30	2.5	.5
60	5.0	1.0

b. To determine the time interval of a recorded wind condition (speed) proceed as follows:

(1) Determine the chart speed used during recording (pars. 28–30).

(2) Use the following chart to determine the time interval between the *curved horizontal* lines.

Time interval between horizontal lines	Chart speed														
	¾ in. per			1½ in. per			3 in. per			6 in. per			12 in. per		
	Sec	Min	Hr	Sec	Min	Hr	Sec	Min	Hr	Sec	Min	Hr	Sec	Min	Hr
Millisec	42			83			16			NA*			NA		
Sec		40			20			10			5			2.5	
Min			40			20			10			5			2.5

*Not applicable.

33. Interpreting Wind Direction Chart Recordings

(fig. 26)

The wind direction (*a* below) and the time interval (*b* below) of any given wind direction condition can be determined from the information on the wind direction chart.

a. The heavy vertical line running through the center of the chart is the centerline reference and is equal to zero. The heavy lines on either side of the centerline reference are equal to 45°. The light lines are equal to 5°. If the recorded point is to the left of the centerline reference, determine the wind direction in accordance with the procedures in (1) through (3) below. If the recorded point is to the right of the centerline reference, determine the wind direction in accordance with the procedures in (4) through (7) below.

(1) For a given point (left of center) on the chart read and note the wind direction in degrees. This is the *chart reading.*

(2) Obtain the compass reading determined in paragraph 15*b.*

(3) Add the chart reading and the compass reading. The result is the wind direction with respect to magnetic north. If the result exceeds 360°, subtract 360° from the result to determine the direction of the wind with respect to magnetic north.

(4) For a given point (right of center) on the chart read and note the wind direction in degrees. This is the *chart reading.*

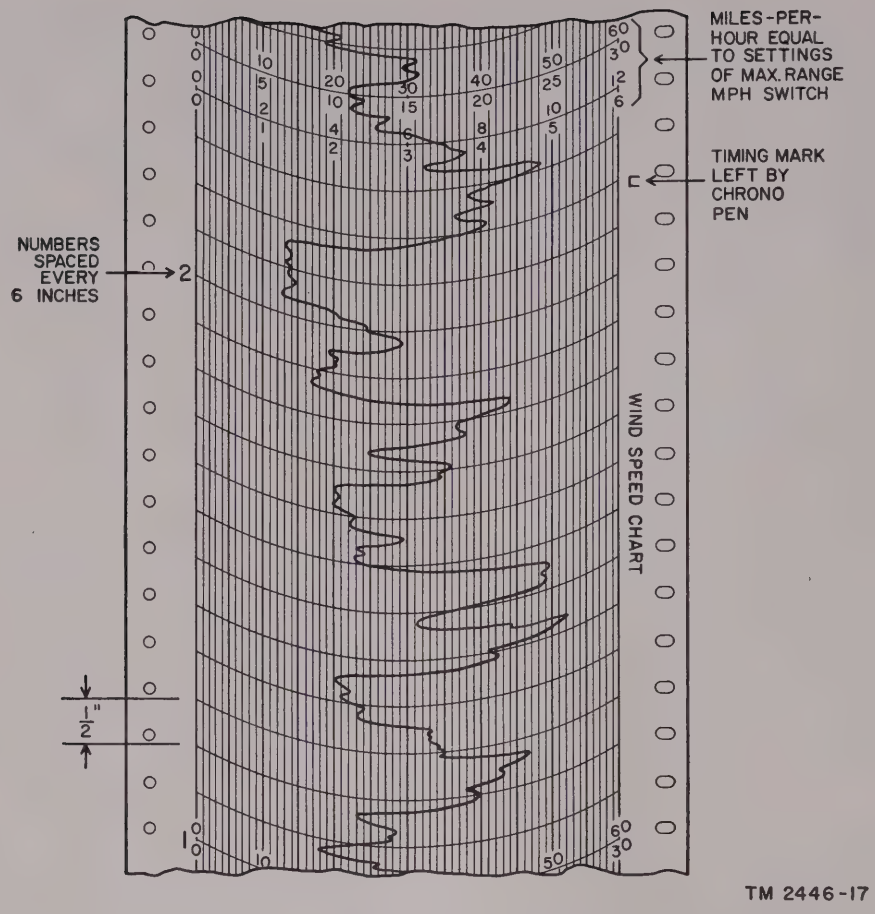

MILES-PER-HOUR EQUAL TO SETTINGS OF MAX. RANGE MPH SWITCH
TIMING MARK LEFT BY CHRONO PEN
NUMBERS SPACED EVERY 6 INCHES
WIND SPEED CHART
1/2"
TM 2446-17

Figure 25. Typical wind speed chart recording.

(5) Obtain the compass reading determined in paragraph 15*b*.

(6) If the chart reading is larger than the compass reading, subtract the compass reading from the chart reading. The result is the wind direction.

(7) If the compass reading is larger than the chart reading, subtract the chart reading from the compass reading. Subtract the result from 360°. The value obtained is the wind direction with respect to magnetic north.

b. To determine the time interval of a recorded wind condition (direction) refer to paragraph 32*b*.

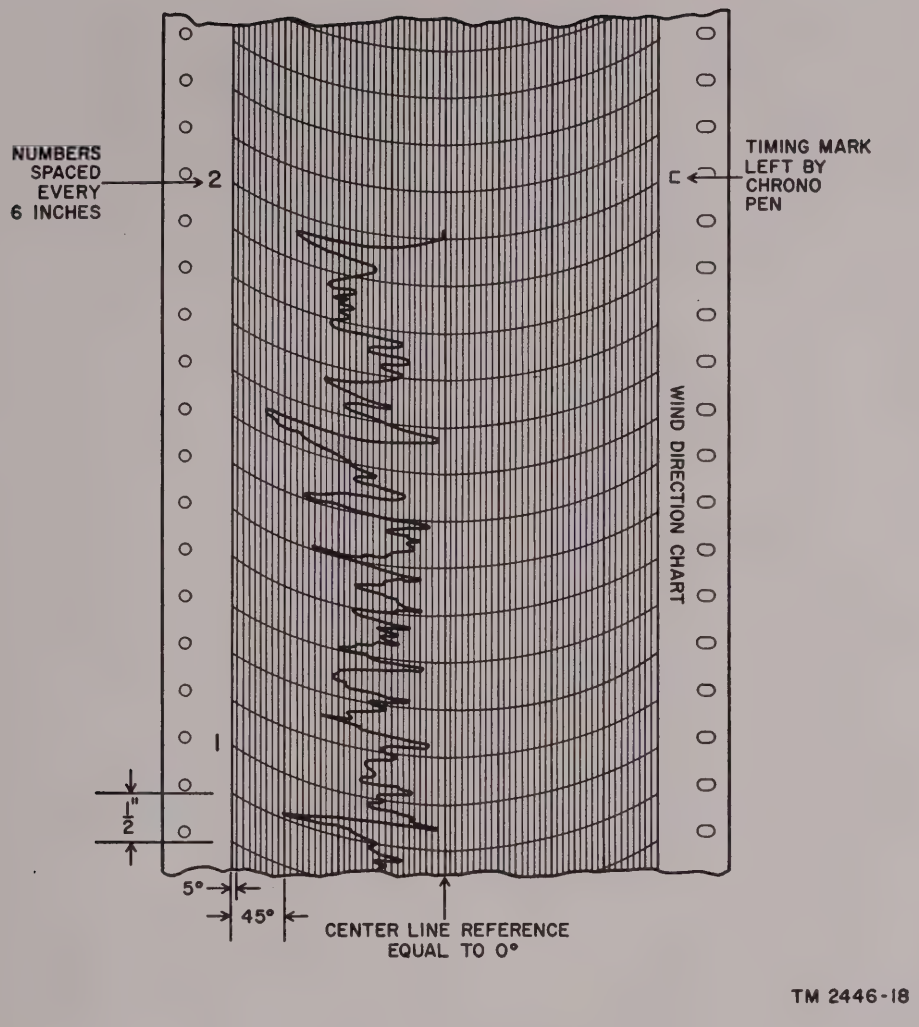


Figure 26. Typical wind direction chart recording.

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

34. Hurricane Conditions

Wind Measuring Set AN/GMQ–12 is not designed for use where winds of hurricane force are expected. If winds of over 100 mph are expected, proceed as follows:

a. Remove the wind speed and wind direction detectors from the crossarm (fig. 10) and store them in their carrying case (fig. 3).

b. Disconnect the hose assembly (fig. 10) and store it in its carrying case (fig. 3).

c. Remove the reducing valve from the nitrogen tank (fig. 10) and store it in its carrying case (fig. 3).

d. Place the valve cover on top of the nitrogen tank and lay the tank on its side.

35. Operation in Arctic Climates

Subzero temperatures and climatic conditions associated with cold weather affect the operation of the wind measuring set. Instructions and precautions for operation under such adverse conditions follow:

a. Ice on the detectors will cause inaccurate readings. Remove the ice carefully so that the bearings in the heads will not be damaged.

b. Keep the vibrator-inverter, amplifier-power supply, and recorder warm and dry. Construct an insulated box for housing the equipment. Keep the

filament power of the tubes on constantly, unless battery is being used. To conserve the heat, place a blanket over the equipment when it is not in use.

c. When equipment which has been exposed to the cold is brought into a warm room, it will sweat until it reaches room temperature. This condition also arises when the equipment warms up during the day after exposure during a cold night. When the equipment has reached room temperature, dry it thoroughly.

d. Use any improvised means to protect the battery, since it will fail if not protected against the cold. To prevent heat loss, place the battery in a bag lined with kapok, spun glass fiber materials, or woolen clothing.

36. Operation in Tropical Climates

When operated in tropical climates, the vibrator-inverter, amplifier-power supply, and recorder may be installed in tents, huts, or, when necessary, in underground dugouts. In the tropics, when equipment is installed below ground or when it is set up in swampy areas, moisture conditions are more acute than normal. Ventilation is usually very poor, and the high relative humidity causes condensation of moisture on the equipment. To minimize condensation, keep the tube heaters turned on or place lighted electric bulbs under the equipment.

37. Operation in Desert Climates

a. When operated in desert climates, a large amount of sand, dust, or dirt may enter the moving parts of the recorder. Make the inclosure in which the vibrator-inverter, amplifier-power supply, and recorder are located as dustproof as possible with available materials. Hang wet sacking over the windows and doors and cover the inside walls with heavy paper. If the equipment is installed in a tent secure the side walls with sand to prevent their flapping in the wind.

d. Do not let the nitrogen supply to the wind speed and wind direction detectors run out. *Do not* attempt to operate the set without nitrogen because the wind speed and wind direction detectors will be damaged.

c. Do not tie any of the cords to either the inside or outside of tents. Desert areas are subject to sudden wind squalls which may jerk the connections loose or break the cords.

d. Keep the equipment as free from dust as possible. Make frequent preventive maintenance checks (pars. 40 and 45). Pay particular attention to the condition of the gears and other moving parts in the recorder. Excessive amounts of dust, sand, or dirt that come into contact with the oil and grease in this unit will result in grit and cause severe damage to the moving parts.

e. A drastic fall in temperature at night often causes condensation. To prevent condensation, cover the equipment with a tarpaulin or similar covering material.

CHAPTER 4

MAINTENANCE INSTRUCTIONS

Section I. OPERATOR'S MAINTENANCE

38. Scope of Operator's Maintenance

a. The following is a list of maintenance duties normally performed by the operator of Wind Measuring Set AN/GMQ–12. These procedures do not require special tools or test equipment.

b. Operator's maintenance for Wind Measuring Set AN/GMQ–12 consists of the following:

(1) Preventive maintenance (par. 40).

(2) Operational checklist (par. 41).

(3) Replacements and adjustments (par. 42).

39. Tools and Materials Required for Maintenance

The following tools and materials are required for performing operator's maintenance:

Screwdriver, ¼-inch wide blade

Open-end wrench, ¼-inch

Cheesecloth, bleached, lint-free

40. Preventive Maintenance

a. Daily.

(1) Keep the equipment clean at all times.

(2) Check the recorder charts for clean, sharp ink lines. If the lines are scratchy or blotted, replace the pen point (par. 27*a*).

(3) Check the chart speed against a stopwatch. The chart speed will be retarded by excessive friction throughout the chart drive mechanism.

Note. When checking chart speed, note the arrangement of the change gears (par. 25).

(4) Visually note the mechanical movement of the wind vane and anemometer.

(*a*) A *hunting* vane indicates a normal condition.

(*b*) Light variable winds will cause the speed of the anemometer to be variable.

(*c*) Report any unusual condition to higher echelon.

(5) Check the tank pressure gage on the reducing valve for nitrogen tank pressure (fig. 10). Replace the nitrogen tank if necessary.

(6) Place the wind measuring set into operation (pars. 28–30) and check for normal operation.

b. Weekly.

(1) Perform all daily checks (*a* above), but do not place the set in operation until the additional following checks are completed.

(*a*) Inspect the inkwells for the condition of the ink and for the presence of sediment. Clean the inkwells and refill them with fresh ink if necessary (par. 27). If the supply is low, add fresh ink. Draw a small amount of ink through the pen with the pen filler to remove any stiffened ink or sediment.

(*b*) Check the adjustments described in paragraph 42*c*.

(2) Place the set in operation (pars. 28–30) and check for normal operation.

41. Operator's Checklist

a. General. The operator's checklist will help the operator to locate trouble quickly. The information contained in the corrective measures column is used to repair trouble. If the measures suggested do not restore normal equipment performance, trouble-shooting is required at a higher echelon. Note on the repair tag how the equipment performed at the time of failure and what corrective measures were taken.

b. Procedure. Place the set in operation (pars. 28–30). After the equipment has had time to warm up, perform the steps shown in *c* below, in the order given. Observe the equipment operation and perform any corrective measures necessary.

c. Checklist.

Action	Normal indication	Corrective measures
1. Observe the wind vane on the wind direction detector.	The wind vane should move with a change in wind direction.	Lower tripod and carefully move wind vane by hand. If there is indication of binding, remove the wind direction detector and forward it to higher echelon for repair.
2. Observe the anemometer on the wind speed detector.	The anemometer should rotate in the wind.	Lower tripod and carefully turn anemometer by hand. *Do not spin.* If there is indication of binding, remove the wind speed detector and forward it to higher echelon for repairs.
3. Observe the operation of the pen elements in the recorders.	Pen elements should draw varying ink lines with changes of wind.	Replace the fuse on the rear panel of the amplifier-power supply. Replace the fuse on the rear panel of the vibrator-inverter (fig. 13). Tighten the battery connections to the vibrator-inverter. Tighten all cord connections. If only one pen element does not write, check the ink through the pen with the pen filler (par. 27) to be sure that the ink has not stiffened or that there are no air bubbles in the pen. Tighten the wind direction cord and the recorder cord connected to the WD TRANSLATOR J502 connector on the recorder. Tighten the wind speed cord and the recorder cord connected to the WS TRANSLATOR J402 connector on the recorder.
4. Operate the HOUR FEEDS MIN. FEEDS switch (fig. 19).	Chart drives operate at proper speed (par. 20*a*).	If the synchronous chart drives are used, install the spring chart drives (pars. 23 and 24) and forward the synchronous chart drives for repair. If the spring chart drives are used, make the necessary adjustments (par. 20). If adjustments do not correct the speed, install the synchronous chart drives (par. 24) and forward the spring chart drive to higher echelon for repair.
Operate external chart drive motor switch.	The motor should start and the chart drive speed should increase to inches per second (par. 29*a*).	Tighten wiring connections at the binding posts on the top of the external chart drive motor. Check the wiring connections to the external chart drive motor switch.
Operate the external chrono switch.	The chronograph pens should leave a mark in the right-hand margin of the charts.	Tighten the wiring connections to the external chrono switch. Fill the chrono pen inkwells. Clean the pens with the pen filler (par. 27).

42. Replacements and Adjustments

Note. The operator must never attempt to repair the wind speed or the wind direction detectors.

a. Pilot Lamps. Replace the pilot lamp mounted on the front of the amplifier-power supply (fig. 18) and the vibrator-inverter if they are defective.

b. Fuses. Replace the fuses mounted on the rear of the amplifier-power supply (fig. 12) and the vibrator-inverter (fig. 13) if they are defective.

Caution: Do not replace with a fuse of higher rating. Damage to the equipment may result.

c. Adjustments.

(1) Adjust the pen element in the wind speed recorder for *zero* by adjusting the zero adjustment control (par. 20*e*).

(2) Adjust the pen element in the wind direction recorder for *zero* (par. 20).

Section II. ORGANIZATIONAL MAINTENANCE

43. Scope of Organizational Maintenance

a. The following maintenance duties are performed by organizational personnel. The scope of these instructions has been determined by the tools, materials, test equipment, and spare parts available to the organization.

b. Organizational maintenance of Wind Measuring Set AN/GMQ–12 consists of the following:

(1) Replacement of defective fuses (par. 42*b*).

(2) Preventive maintenance (par. 45).

(3) Equipment performance checklist (par. 46).

(4) Replacement of defective tubes (par. 47).

(5) Replacement of wind speed and wind direction detectors (par. 45*a*).

44. Tools, Materials, and Test Equipment Required

In addition to the tools and materials listed in paragraph 39, the following test equipment is required for organizational maintenance.

Tube Tester TV–7/U

Multimeter TS–297/U

Tube Puller TL–201

Solvent, Dry cleaning (SD)

45. Organizational Preventive Maintenance Procedures

In addition to the preventive maintenance procedures in paragraph 40, perform the following:

a. Wind Speed and Wind Direction Detectors. After 6 months of normal use, replace the wind speed detector with a known good one. After 1 year of normal use, replace the wind direction detector with a known good one. Forward the detectors removed to higher echelon for test, calibration, and possible repair.

Caution: Organizational maintenance personnel must not attempt to troubleshoot, disassemble, or repair the wind speed detector or the wind direction detector.

b. Recorder.

(1) Inspect the inside of the recorder case for dirt and moisture.

(2) Inspect and tighten screws and nuts.

(3) Disconnect the power cords and recorder cords and inspect the condition of the connectors on the cords (fig. 16) and rear panel of the recorder (fig. 14). Remove any dirt and moisture.

(4) Remove the instruction plates on the front of both synchronous chart drives and check motors for evidence of overheating.

(5) Reconnect all cords.

c. Amplifier-power Supply.

(1) Remove the amplifier-power supply from the housing and inspect the chassis for dirt and moisture.

(2) Turn the ON-OFF switch to ON and check to see that all tubes and the dial lamp glow. Turn the ON-OFF switch to OFF.

(3) Check and tighten all screws and nuts.

(4) Check to see that a spare fuse is in the SPARE fuse holder on the rear panel.

(5) Inspect the MAX. RANGE MPH switch on the front panel for binding, scraping, excessive looseness, and for positive action.

(6) Inspect the transformers and coils for evidence of leakage.

(7) Inspect resistors, bushings, and insulators for cracks, chipping, blistering, discoloration, and moisture.

(8) Replace the amplifier-power supply in its housing.

(9) Disconnect all cords connected to the rear panel and inspect the condition of all connectors. Remove any dirt or moisture.

(10) Reconnect all cords.

d. Vibrator-inverter.

(1) Remove the vibrator-inverter from its housing.

(2) Inspect the chassis for dirt and moisture.

(3) Inspect resistors, bushings, and insulators

for cracks, chipping, blistering, discoloration, and moisture.

(4) Clean and tighten connections and mountings for the transformer.

(5) Inspect the transformer and the coil for signs of overheating.

(6) Replace the vibrator-inverter in its housing.

(7) Check the associated battery for cracks. Test for full charge.

46. Equipment Performance Checklist

The equipment performance checklist will help the organizational maintenance man to locate trouble in the equipment. The list gives the item to be checked, the conditions under which the item is checked, the normal indications and tolerances of correct operation, and the corrective measures the organizational maintenance man can take. To use this list, follow the items in numerical sequence.

a. Ac Operation.

	Item No.	Item	Action or condition	Normal indications	Corrective measures
PREPARATORY	1	Chart drives in recorder.	Install red change gears (par. 25).		
	2	HOUR FEEDS-MIN. FEEDS switch on wind speed recorder or external chart speed switch (shorting plug).	Set to MIN. FEEDS position or if an external chart speed switch has been installed, set the HOUR FEEDS-MIN. FEEDS switch to HOUR FEEDS and close the external chart drive motor switch. (If external chart drive switches are not installed, insert shorting plug P403 into WS–WD CHART FEEDS connector J403 (par. 24c)).		
	3	Pen elements and inkwells.	Fill and install the pen elements and inkwells (par. 27).		
	4	Chrono pens.	Fill and install the chrono pens (par. 27).		
	5	Recorder.	Install charts (par. 26).		
START	6	Amplifier-power supply ON-OFF switch.	Set to ON.	Pilot light and all tubes glow.	Check fuse in rear panel. Check the tubes. Check the power transformer (par. 67).
	7	ON-OFF switches on chart drives in recorder (fig. 19).	Set both switches to ON.	Both chart drives operate.	Check power cord connections (fig. 16). Remove the chart drive from the case (pars. 23 and 24) and check the contact block on the back of the chart drive and on the inside of the recorder case.

	Item No.	Item	Action or condition	Normal indications	Corrective measures
EQUIPMENT PERFORMANCE	8	Wind speed recorder.	Anemometer on wind speed detector turns in the wind.	Wind speed recorder produces a chart reading.	Check the MAX. RANGE MPH switch on each position. Check the switch contacts. Replace the wind speed detector. Turn in equipment for repair.
	9	Wind direction recorder.	Wind vane on wind direction detector moves in a *hunting* action in the wind.	Wind direction recorder produces a chart reading.	Adjust wind direction circuit (par. 20). Check tubes V1 and V5 in the amplifier-power supply (par. 47).
	10	Chart drives in recorder.	Check chart speed (par. 40*a*).	Charts feed at 6 inches per minute.	Check for defective gears and binding due to misalinement of shafts (par. 66). Check drive motor in wind speed recorder.
	11	External chrono pen switch.	Close the switch momentarily.	Both chrono pens in recorder make a mark in the right-hand margin of the chart.	Check cord connections at CHRONO connector on the rear panel of the recorder. Check wiring connections to the chrono pen relays K402 and K501.
	12	External chart drive motor.	Set ON-OFF switch on the top of the external chart drive motor to ON. If an external chart drive motor switch has been installed turn it on.	The external chart drive motor starts. Chart drives increase to a speed of 6-inches per second.	Check wiring connections to the external chart drive motor. Inspect the gears in the gear housing of the external chart drive motor. Check the drive motor in the wind speed recorder.
STOP	13	Amplifier-power supply ON-OFF switch.	Set to OFF.		
	14	Recorder chart drive ON-OFF switches.	Set both switches to OFF.		
	15	External chart speed switch.	Set to OFF.		
	16	Chart drives in recorder.	Install the original set of change gears (par. 25*b*).		

b. Dc Operation.

PREPARATORY	1	Chart drives in the recorder.	Wind up the motors (par. 24*a*). Install red change gears (par. 25).		
	2	Pen elements and inkwells.	Fill and install the pen elements and inkwells (par. 27).		
	3	Chrono pens.	Fill and install the chrono pens (par. 27).		
	4	Recorder.	Install charts (par. 26).		

	Item No.	Item	Action or condition	Normal indications	Corrective measures
START	5	Vibrator-inverter ON-OFF switch.	Set to ON.	Pilot lamp glows.	Listen for audible indication that vibrator is operating. Check fuse F1 on rear panel (fig. 13). Check connections to battery. Check battery. Check pilot lamp.
	6	Amplifier-power supply ON-OFF switch.	Set to ON.	Pilot lamp and all tubes glow.	Check power cord connections. Check fuse F1 on rear panel (fig. 12). Check the power transformer.
	7	MIN. FEEDS-HOUR FEEDS-STOP switch on wind speed recorder chart drive.	Set to MIN. FEEDS.	Both chart drives start.	Check drive motor in wind speed chart drive. Check for broken gears and binding shafts.
EQUIPMENT PERFORMANCE	8	Wind speed recorder.	Repeat item No. 8 in *a* above.		
	9	Wind direction recorder.	Repeat item No. 9 in *a* above.		
	10	Chart drives in recorder.	Repeat item No. 10 in *a* above.		
	11	External chrono pen switch.	Repeat item No. 11 in *a* above.		
STOP	12	MIN. FEEDS-HOUR FEEDS-STOP switch on wind speed recorder chart drive.	Set to STOP.		
	13	Amplifier-power supply ON-OFF switch.	Set to OFF.		
	14	Vibrator-inverter ON-OFF switch.	Set to OFF.		

47. Electron Tube Replacement Procedure

Caution: Organizational maintenance personnel must not attempt to test or replace tubes in the wind speed detector.

To avoid excessive replacement of electron tubes, follow the procedure outlined below:

a. Inspect cables, connections, and the general condition of the equipment before removing electron tubes.

b. Isolate the trouble, if possible, to a particular unit or section of the equipment.

c. If a tube tester is available, remove and test one tube at a time. Substitute new tubes only for those that are defective.

d. If a tube tester is not available, troubleshoot by the following tube substitution method:

(1) Replace any suspected tubes, one at a time, with new tubes. Note the sockets from which the original tubes were removed. If the equipment becomes operative, discard the last tube removed.

Note. The switching circuit (V2, fig. 33) may function with one tube and not another, even though both tubes are new. If practicable, retain any removed tube until its condition is checked by a suitable test instrument.

(2) Reinsert the remaining original tubes, one at a time, in the original sockets. If equipment failure occurs during this step, discard the last original tube. *Do not leave a new tube in a socket if the equipment operates satisfactorily with the original tube.*

(3) If there is a sufficient number of spare tubes, substitute a new tube for an original tube. Similarly, check each original tube, in turn, until the equipment becomes operative.

e. If tube substitution does not correct the trouble, *reinsert the original tubes in the original sockets* before forwarding the defective equipment for higher echelon repair.

(1) As a general rule, *discard* tubes when—

(*a*) A test in a tube tester or other instrument shows that the tube is defective.

(*b*) The tube defect is obvious. *For example,* the glass envelope is broken or a connecting prong or lead is broken.

(2) Do not discard tubes merely because the tubes have been used for a specified length of time. *Satisfactory operation in a circuit is the final proof of tube quality. The tube in use may work better than a new one.*

(3) Do not discard tubes merely because they fall *on or slightly above* the minimum acceptable value when checked in a tube tester. A certain percentage of new tubes fall near the low end of the acceptable range of the tube specification and, therefore, start their operational life at a value fairly close to the tube tester *retention limit.* These tubes may provide satisfactory performance throughout a long period of operational life at the *near limit* value.

(4) Be very careful when withdrawing a miniature tube from its socket. Do not *rock* or *rotate* the top of a miniature tube when removing it from a socket; use a tube puller to pull it straight out. The external pin and the wire lead sealed in the glass base are two different metals butt-welded together where the pin appears to enter the glass. Rocking or rotating the tube bends the pins; this tends to break the weld or cause a resistance or intermittent joint to develop.

48. Preferred-type Tubes

A preferred type electron tube, type 5726/6AL5W, has been developed as a direct replacement for tube type 5726. These tubes may be used interchangeably in the switching and gating diode circuits of the amplifier-power supply.

49. Lubrication

(figs. 27–29)

a. Type of Lubricant.

Lubricant	*Description*
PL	Oil, Lubricating Preservative Special
GL	Grease, Aircraft and Instrument

b. Lubrication Precautions.

(1) Do not over lubricate. Excessive lubrication may spread to the *drive roll* and *reroll* surfaces and be transferred to the chart paper.

(2) Do not use an oilcan. Drop a small clean No. 21 wire in the lubricant to a depth of ½ inch. Transfer the drop which adheres to the wire to the lubrication point.

c. Semiannual Lubrication.

(1) Lubricate the drive gears and shafts, and the reroll gears and shafts (fig. 27) with three drops of lubricant (PL).

(2) Lubricate the motor gears and shafts and reroll gears and shafts (fig. 28) with three drops of lubricant (PL).

(3) Lubricate the motor gears and shafts (fig. 29) with three drops of lubricant (PL). Apply grease (GL) sparingly to the worm gear.

d. Biennial Lubrication. The external chart drive motor bearings must be lubricated every 2 years. Refer the unit to higher echelon.

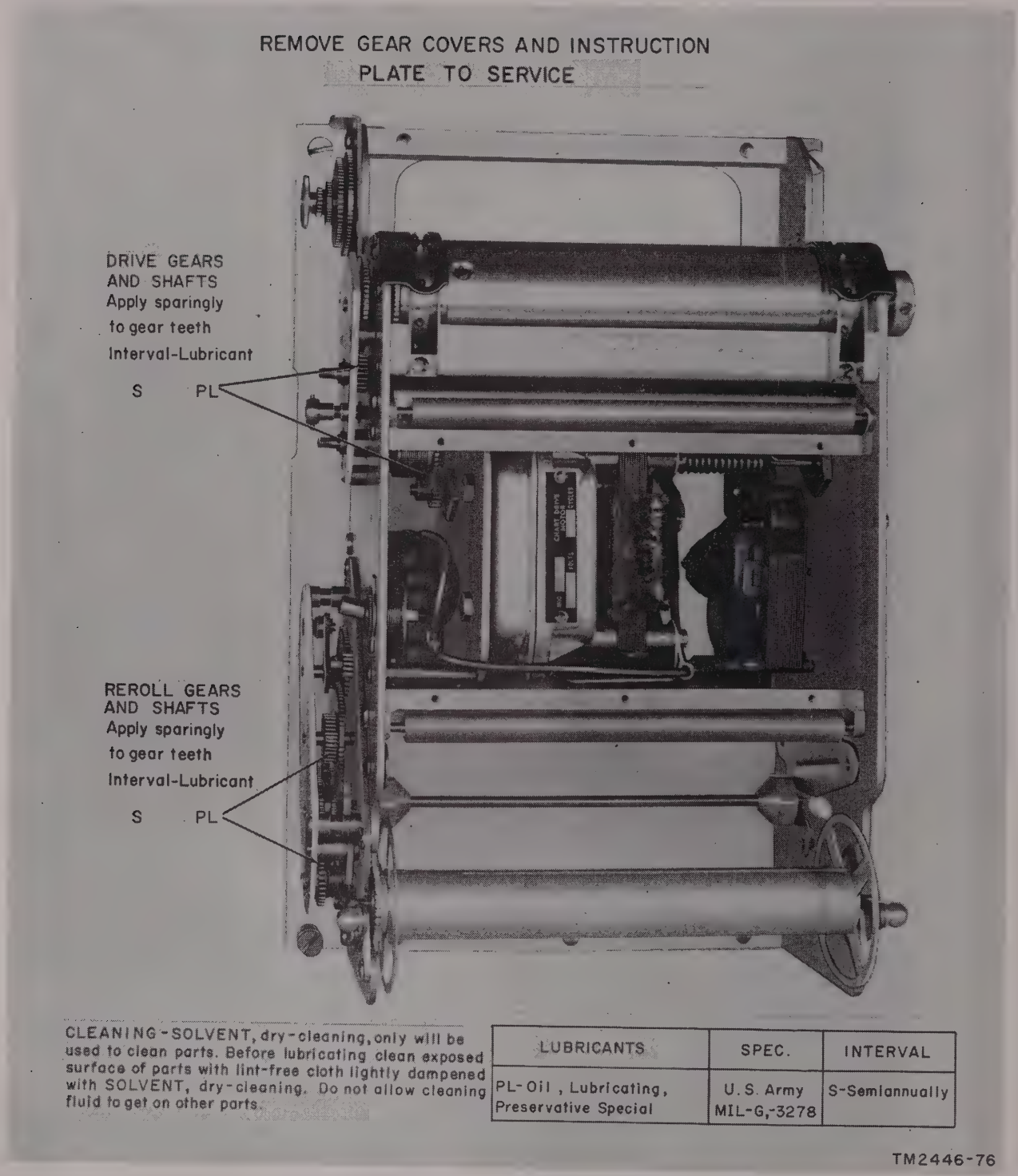

REMOVE GEAR COVERS AND INSTRUCTION PLATE TO SERVICE
DRIVE GEARS AND SHAFTS
Apply sparingly to gear teeth
Interval-Lubricant
S PL
REROLL GEARS AND SHAFTS
Apply sparingly to gear teeth
Interval-Lubricant
S PL
CLEANING - SOLVENT, dry-cleaning, only will be used to clean parts. Before lubricating clean exposed surface of parts with lint-free cloth lightly dampened with SOLVENT, dry-cleaning. Do not allow cleaning fluid to get on other parts.
LUBRICANTS | SPEC. | INTERVAL
PL- Oil , Lubricating, Preservative Special | U.S. Army MIL-G,-3278 | S-Semiannually
TM2446-76

Figure 27. Lubrication, synchronous chart drives.

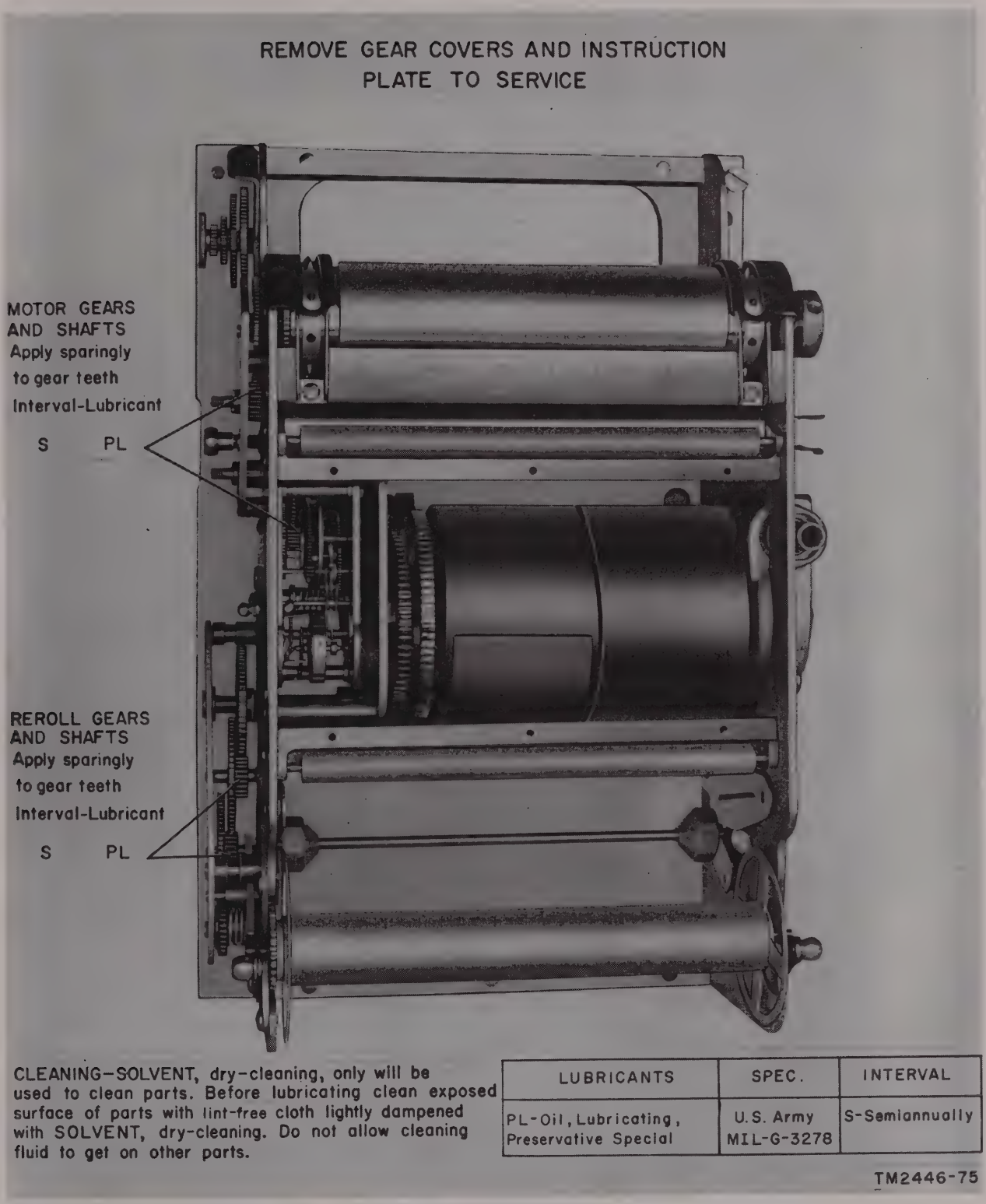

REMOVE GEAR COVERS AND INSTRUCTION PLATE TO SERVICE
MOTOR GEARS AND SHAFTS
Apply sparingly to gear teeth
Interval-Lubricant
S PL
REROLL GEARS AND SHAFTS
Apply sparingly to gear teeth
Interval-Lubricant
S PL
CLEANING—SOLVENT, dry-cleaning, only will be used to clean parts. Before lubricating clean exposed surface of parts with lint-free cloth lightly dampened with SOLVENT, dry-cleaning. Do not allow cleaning fluid to get on other parts.
LUBRICANTS | SPEC. | INTERVAL
PL-Oil, Lubricating, Preservative Special | U.S. Army MIL-G-3278 | S-Semiannually
TM2446-75

Figure 28. Lubrication, spring chart drives.

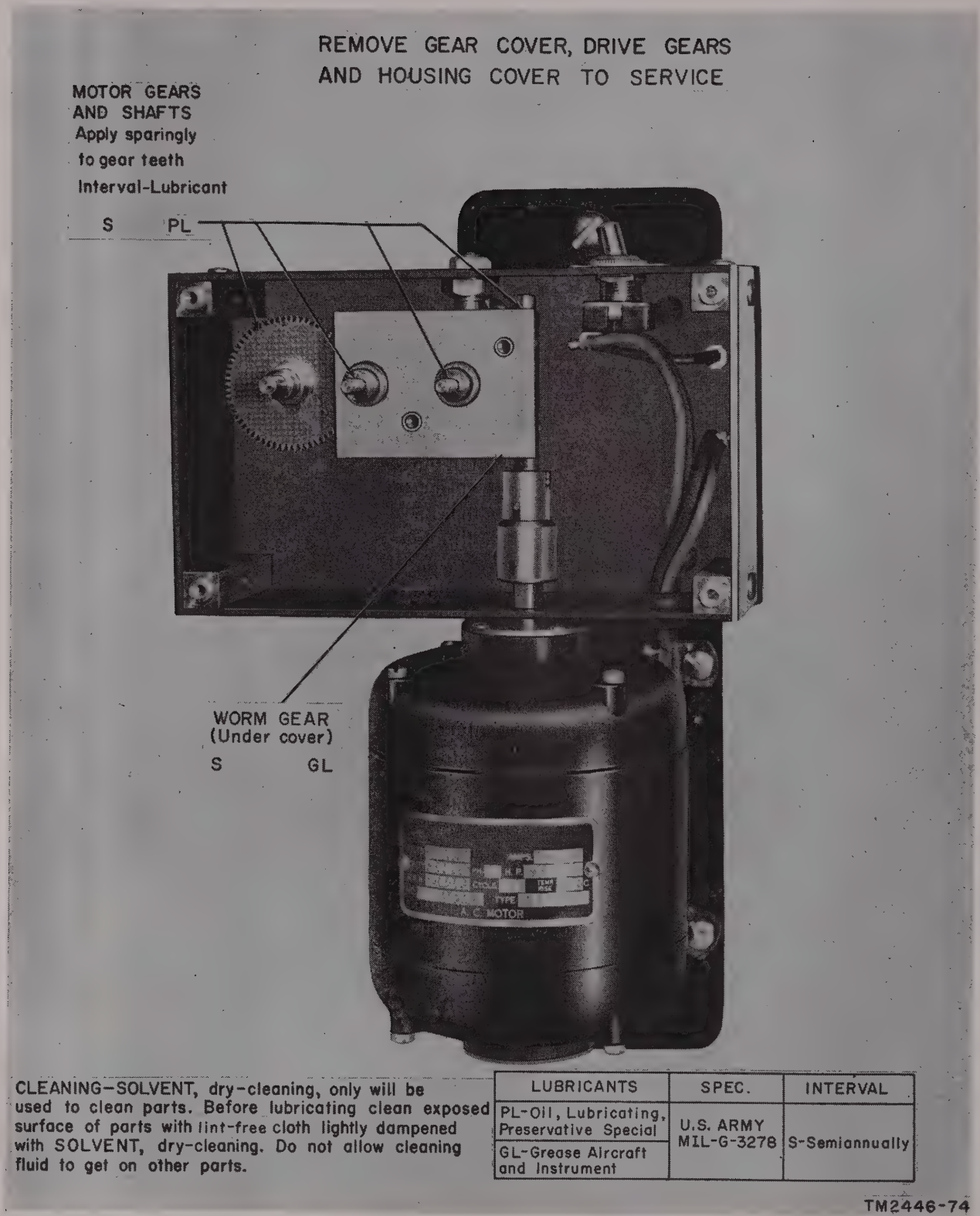


Figure 29. Lubrication, external chart drive motor.

CHAPTER 5

THEORY

Section I. GENERAL THEORY

50. Introduction

Wind Measuring Set AN/GMQ–12 contains a wind speed detector which converts wind speed values into electrical values for the purpose of recording and a wind direction detector which converts wind direction values into electrical values also for the purpose of recording.

51. Block Diagram Analysis

(fig. 30)

a. The exciter lamp of the wind speed detector furnishes a beam of light which is fed through a light chopper to a phototube. The light chopper is mechanically connected to an anemometer which is rotated by the wind. Rotation of the anemometer causes the light chopper to interrupt the light beam to the phototube. The wind speed determines the rate of interruption of the light beam. The phototube converts the interrupted light into electrical pulses that are applied to the clipper amplifier and cathode follower.

b. The electrical pulses from the wind speed detector are applied to a clipper amplifier in the amplifier-power supply. The amplified electrical pulses are applied to a switching circuit that converts ac electrical pulses to a varying dc voltage.

c. The dc voltage from the amplifier-power supply is applied to the pen movement in the wind speed recorder. The pen marks an inked line on a chart roll. This inked line can be interpreted to give the wind speed and the duration of any gust.

d. The wind vane of the wind direction detector is mechanically coupled to the arm of a variable resistor. The position of the variable resistor arm, which is determined by the direction of the wind, determines the amount of dc voltage applied to the amplifier-power supply.

e. The dc voltage from the wind direction detector acts as a bias for a current amplifier in the amplifier-power supply. The cathode circuit of the current amplifier is connected to the pen movement in the wind direction recorder.

f. Current flow through the pen movement causes the pen to mark an inked line which records the wind direction and the duration of any change of wind direction.

g. Ac power is furnished to the recorder from a 110- to 125-volt, 60-cycle source, or from the vibrator-inverter operating from a 6-volt battery. The low voltage rectifier furnishes the filament voltage for all the tubes, and the voltage for the exciter lamp. The high voltage rectifier and the voltage regulator furnish the plate and screen grid voltages for the various stages.

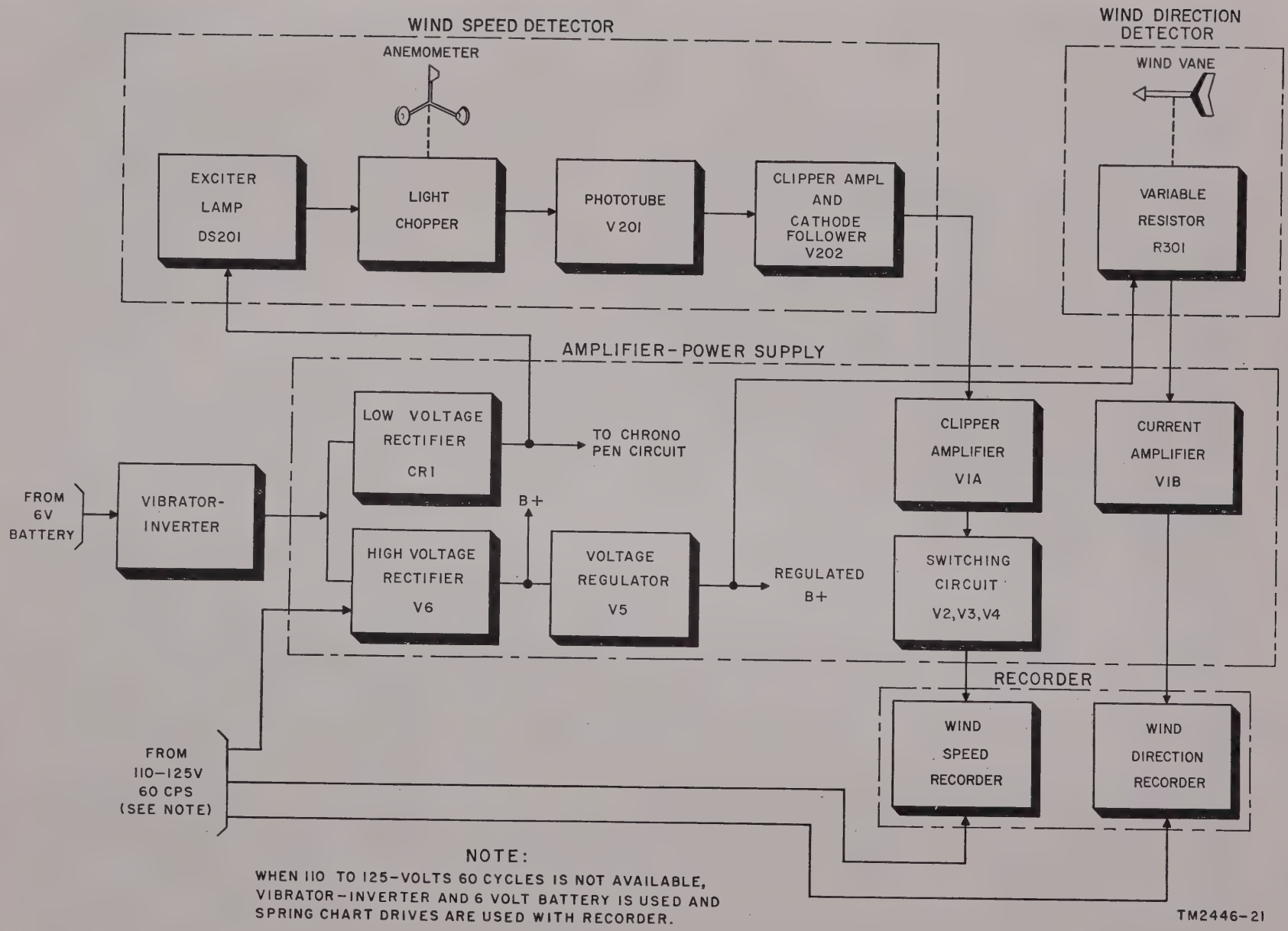


Figure 30. Block diagram.

Section II. WIND SPEED CIRCUIT

Note. To describe the theory of operation of the wind measuring set, the equipment has been divided into five circuits: the wind speed circuit, the wind direction circuit, the power supply circuit, the recorder circuit and the vibrator-inverter circuit.

52. Wind Speed Detector Circuit

(fig. 31)

a. The light chopper driven by the anemometer is a circular wheel with 100 radial slots. Exciter lamp DS201 is positioned above the light chopper. The light chopper interrupts the light beam 100 times per revolution.

b. When the light beam strikes phototube V201, the tube conducts. A positive potential is developed between cathode terminal, pin 3, and ground. When the light beam from exciter lamp DS201 is interrupted by the light chopper, no current is generated in phototube V201 and the cathode is at ground potential. Thus, during operation, a signal consisting of positive pulses is developed at pin 3 of phototube V201. The repetition rate of these pulses is 100 times the rotational speed of the anemometer and the light chopper. This signal is applied to the grid of clipper amplifier V202A through limiting resistor R204. Resistors R201 and R202 form a voltage divider for reducing the B+ voltage applied to phototube V201.

c. When clipper amplifier V202A receives its input signal, it draws enough plate current to cause the plate voltage to drop to a value too low to maintain linear operation. This causes a clipping action so that the negative peak of the amplified pulse receives little or no amplification. The resultant wave shape then approaches a rectangular shape. Resistor R206 is the cathode bias resistor for clipper amplifier V202A. Capacitor C201 maintains the cathode of clipper amplifier V202A at ground potential for the signal frequencies. The clipping action of clipper amplifier V202A makes the output wave shape and level relatively immune to tube and component variations. It also maintains a fixed output level under all conditions of operation.

d. The amplified signal from clipper amplifier V202A is applied to the grid of cathode follower V202B. Resistor R207 is the cathode load resistor for cathode follower V202B. The output signal from the cathode is applied to terminal A of connector P201. Cathode follower V202B provides relatively low impedance to the interconnecting cable between the wind speed detector and the amplifier-power supply.

e. Terminal B of connector J201 connects to the +215 plate supply voltage from the amplifier-power supply. Terminal D of connector J201 is the ground terminal. Terminal C connects to the exciter voltage supply.

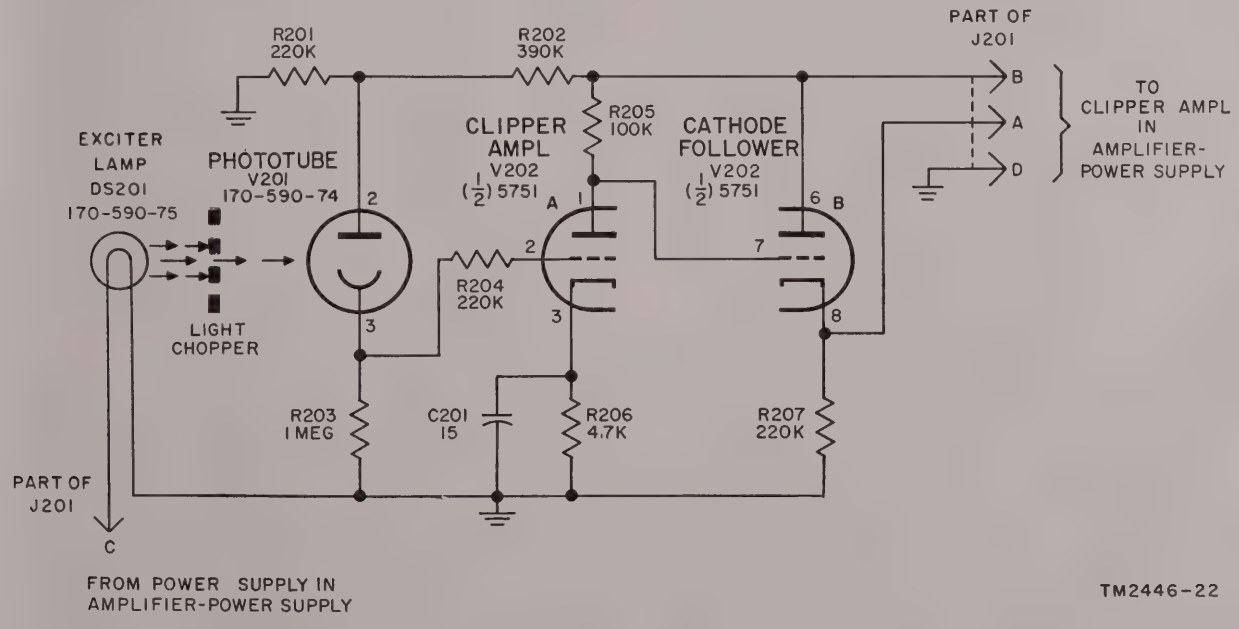


Figure 31. Wind speed detector, simplified schematic diagram.

53. Wind Speed Amplifier Circuit

(figs. 32 and 33)

a. Figure 32 is a simplified schematic of the clipper amplifier circuit in the amplifier-power supply. Resistors R5 and R7 form a voltage divider to cut off clipper amplifier V1A when there is no incoming signal. The incoming pulses from the wind speed detector enters the clipper amplifier of the amplifier-power supply through terminal A of connector J1 and pass through coupling capacitor C2 and limiting resistor R3 to the grid of clipper amplifier V1A. The pulses arriving at the grid of clipper amplifier V1A have nearly equal positive and negative amplitude with respect to ground. The negative portion of each pulse drives the tube far into the cutoff region. The positive portion of each pulse drives the tube into heavy conduction. Plate load resistor R2 is high enough in value to permit plate current saturation during conduction. The clipped wave form produced by clipper amplifier V1A is passed to the switching circuit.

b. Resistor R4 is the grid return resistor for clipper amplifier V1A. Resistor R1, in combination with capacitor C14C, drops the B + voltage and provides additional filtering for the B + voltage applied to the plate circuit of the wind speed detector.

c. Figure 33 is a simplified schematic diagram of the switching circuit in the amplifier-power supply. Incoming signals are applied through coupling capacitor C3 and voltage limiting resistor R8 to the grid of switching input amplifier V2A. Cutoff bias is obtained from cathode resistor R9 in conjunction with resistor R10 when there is no incoming signal. Plate voltage is obtained from the series combination of the secondary winding of transformer T3 (terminals 3 and 4), switching diode V3A, and resistor R11. Switching diode V3A does not conduct when switching input amplifier V2A is at cutoff.

d. When an incoming signal is present, the positive portion of the input pulse lowers the effective plate resistance of switching input amplifier V2A and causes a surge of current through resistor R11, switching diode V3A, and the secondary winding of transformer T3. As a result of this current surge, a negative voltage is coupled through capacitor C4 to the control grid of switching output amplifier V2B. This current surge is also passed through the primary winding of transformer T3. The phasing of the transformer connections produces regenerative action because of the voltage induced in the secondary winding. Thus, the increase of current in the primary of transformer T3 develops a positive potential at the cathode of switching diode V3A which, in turn, reinforces the negative voltage at the grid of switching output amplifier V2B. Tube V3B, which is normally conducting heavily, is cut off in an extremely short time following the reception of the negative voltage from switching output amplifier V2B.

e. Free running operation of the regenerative circuit formed by switching input amplifier V2A,

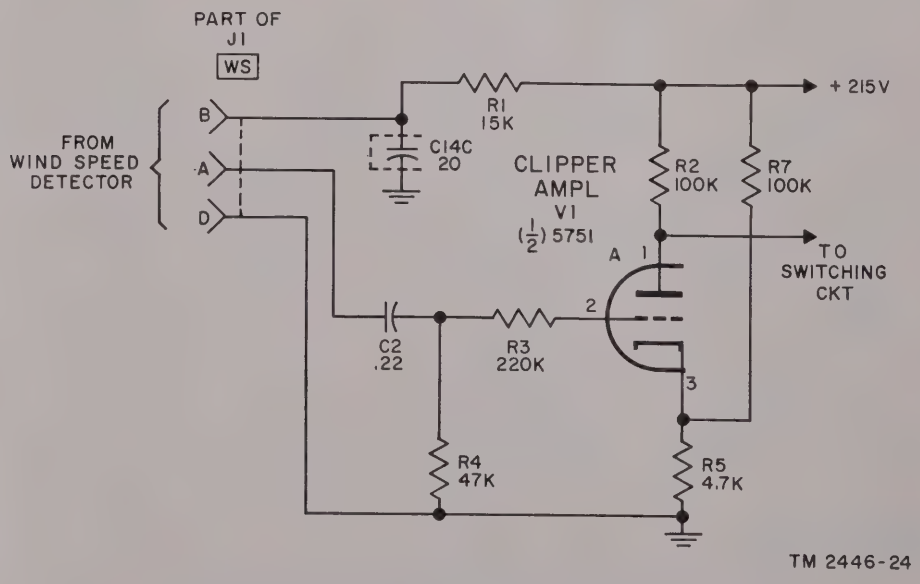


Figure 32. Clipper amplifier, simplified schematic diagram.

switching output amplifier V2B, and transformer T3 is prevented by the isolating action of switching diode V3A. This tube permits only one-half cycle of regenerative switching since the successive half cycle causes its cathode to be positive with respect to its plate. Under this condition, the switching diode acts as an open switch, thereby blocking the feed-back path. Capacitor C15 bypasses noise, transient and parasitic voltages which might otherwise influence the triggering of the switching circuit.

f. Gating diode V3B clamps the peak-to-peak plate potential swing of switching output amplifier V2B to exactly 108 volts. This is the final step in obtaining a frequency which varies with wind speed but which is fixed in amplitude. The plate of gating diode V3B is connected to the junction of resistor R21 and pin 2 of amplifier regulator V4. The potential of this circuit junction with respect to ground is equal to the B+ voltage at pin 1 of amplifier regulator V4 minus the potential drop across amplitude regulator V4. The nominal B+ voltage at pin 1 of amplitude regulator V4 is 215 volts. The potential drop across amplitude regulator V4 is 108 volts. Therefore, the junction of R21 and pin 4 of amplitude regulator V4 is 107 volts with respect to ground.

g. When switching output amplifier V2B is cut off, its plate voltage with respect to ground is +215 volts. During conduction, the voltage drop across plate load resistor R13 results in reversal of the relative polarities of the elements of gating diode V3B. The cathode of gating diode V3B is now negative with respect to its plate. This causes gating diode V3B to conduct which connects the 107-volt circuit junction to the plate of switching output amplifier V2B. Since the plate voltage of switching output amplifier V2B was +215 volts when the tube was cut off, the peak-to-peak voltage value of the wave form produced across plate load resistor R13 is +215 volts −107 volts, or 108 volts.

h. The +108-volt value is fixed by amplifier regulator V4 and is independent of the unregulated B+ voltage. For example, if the unregulated B+ voltage is 225 instead of 215, the voltage with respect to ground at pin 4 of amplitude regulator V4 would be 117 volts. The peak-to-peak voltage value of the wave form developed across the plate load resistor R13 would now be +225 volts −117 volts, which again is +108 volts. Thus, the peak-to-peak voltage of the wave form is clamped at +108 volts by the combined action of amplitude regulator V4 and gating diode V3B.

i. The +108-volt change in potential across plate load resistor R13 charges the capacitors selected by switch S4. The meter element in the wind speed recorder is in series with the charging path of the capacitor. The deflection produced in the meter element of the wind speed recorder is proportional to the frequency of the charging pulses.

j. The capacitors connected to switch S4 consist of a base capacitor (C5A, C6A, C7A, and C8A) for the four wind speed ranges with one or two padder capacitors connected in parallel with the base capacitor. Capacitor C5B is the padder for C5A, capacitor C6B for capacitor C6A, capacitor C7B for capacitor for C7A, and capacitor C8B for capacitor C8A. Capacitors C5B, C6B, C7B, and C8B may consist of one or more capacitors as determined by testing the switching circuit. The capacitors are progressively smaller as the wind speed range increases because higher charging frequencies are involved. Therefore, a smaller capacitor is required to limit the average charging current to that corresponding to a full scale deflection of the wind speed recorder.

k. The charging of capacitors associated with switch S4 begins at the instant that switching output amplifier V2B is cut off. The charging path is completed to ground through diode CR2 and the meter element of the wind speed recorder. When switching output amplifier V2B conducts, diode CR3 provides a separate path to ground for the reversed charge polarity produced in the selected range capacitor. This prevents the meter element in the wind speed recorder from being subjected to a counter torque. This charge current is blocked by diode CR3 and passed to the meter element by diode CR2. Discharge current is blocked by diode CR2 and passed to ground by diode CR3.

l. Resistor R18 is the meter element shunt resistor. The value is selected to adjust the meter deflection to full scale. Selection is necessary to overcome slight cumulative tolerances of regulator tubes and circuit parameters.

m. Resistors R14 through R17 prevent the anemometer from overcoming bearing friction until a wind speed of ½ mile per hour is attained. One resistor is selected by the setting of switch S4. The selected resistor provides a residual deflection current to the meter element in the wind speed recorder that is equal to an average change current corre-

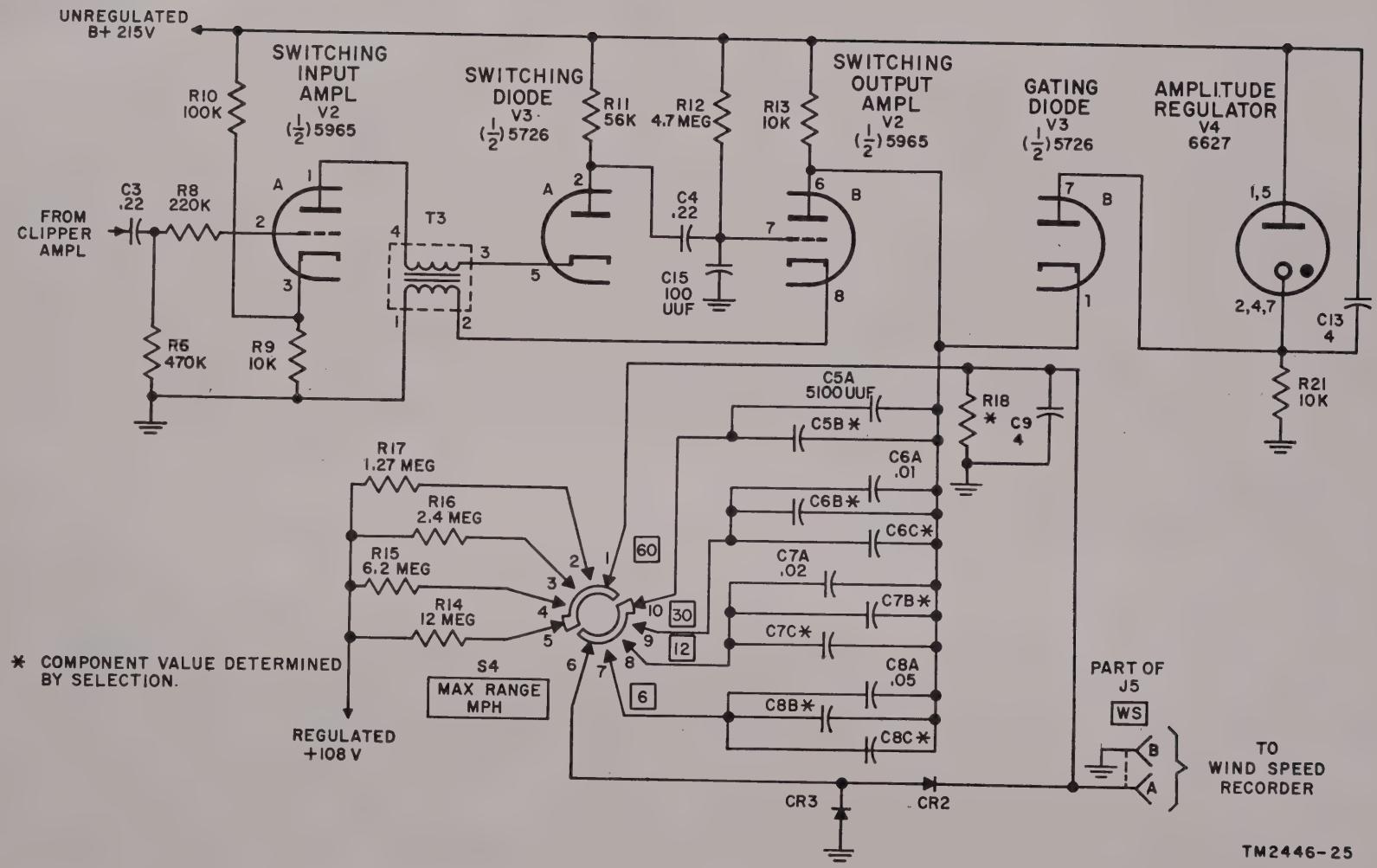


Figure 33. Switching circuit, simplified schematic diagram.

sponding to a wind speed of ½-mile per hour. The source of the residual deflecting current is the regulated voltage developed across voltage regulator V5 in the power supply circuit. Resistors R14 through R17 increase in value as the wind speed setting of switch S4 increases. A high resistance in this circuit produces less residual deflection current than a low resistance. Less deflection of the meter element is required for ½-mile-per hour indication at high speeds than at low speeds so that less residual deflection current must be supplied to the meter element as the wind speed range increases.

Section III. WIND DIRECTION CIRCUIT

54. Wind Direction Detector Circuit

a. Figure 34 is a simplified schematic diagram of the wind direction detector and amplifier circuit. The wind vane is mechanically coupled to the shaft of variable resistor R301 in the wind direction detector. Variable resistor R301 receives voltage through terminal D of connector J301. This regulated voltage is supplied by voltage regulator V5 in the power supply and is passed through voltage dropping resistors R19 and R28 before being passed through the wind direction cord to variable resistor R301. Terminal C of connector J301 provides ground, and terminal A of connector J301 is connected to the arm of variable resistor R301.

b. Variable resistor R301 turns continuously throughout a 360° range. Only 354° of the 360° are electrically useful because of the arc occupied by the resistor terminals. A sighting bar is attached to a tubular rod at the bottom of the wind direction detector housing. This bar is alined with the exact midresistive range of variable resistor R301. The midresistive range of variable resistor R301 is the equivalent of a midscale reading of the wind direction recorder. During installation, the sighting bar is pointed into the prevailing wind at an object of known azimuth.

55. Wind Direction Amplifier Circuit

a. The load circuit of cathode follower V1B consists of the series combination of resistor R20 and the meter element in the wind direction recorder. Resistor R29 is the grid return resistor. The plate of cathode follower V1B is supplied with regulated voltage from voltage regulator V5 in the power supply circuit.

b. The dc voltage applied to the grid of cathode follower V1B is governed by the position of the arm in variable resistor R301 in the wind speed detector. This, in turn determines the cathode current and, therefore, the deflection of the meter element in the wind direction recorder.

c. FULL SCALE ADJ R28, is used to adjust the meter element in the wind direction recorder for full scale deflection when vairable resistor R301 in the wind speed detector is bypassed by the action of switch S3. Switch S3 is a momentary action switch that connects terminal B of connector J6 (input from wind speed detector) through the contacts of switch S5 to the grid of tube V1B. When switch S3 is held in the momentary-action position, the voltage applied to the grid of cathode follower V1B is equivalent to the minimum resistive position of variable resistor R301 in the wind direction detector. This causes a full scale deflection of the meter element in the wind direction recorder.

d. Switch S5 is a momentary-action switch that connects the contacts of switch S3 to the grid of cathode follower V1B. Switch S5, in the momentary-action position, causes zero voltage at the grid of tubes V1B. This is equivalent to the voltage delivered by variable resistor R301 in the wind speed detector when it is in its maximum resistive position. The current flow of tube V1B is not cut off completely, however, when zero voltage is applied to its grid. The deflection due to the residual current flow in tube V1B when its grid voltage is zero must be manually adjusted by the zero adjustment located in the bottom of the wind direction recorder case. The output of tube V1B is connected to terminal A of connector J2.

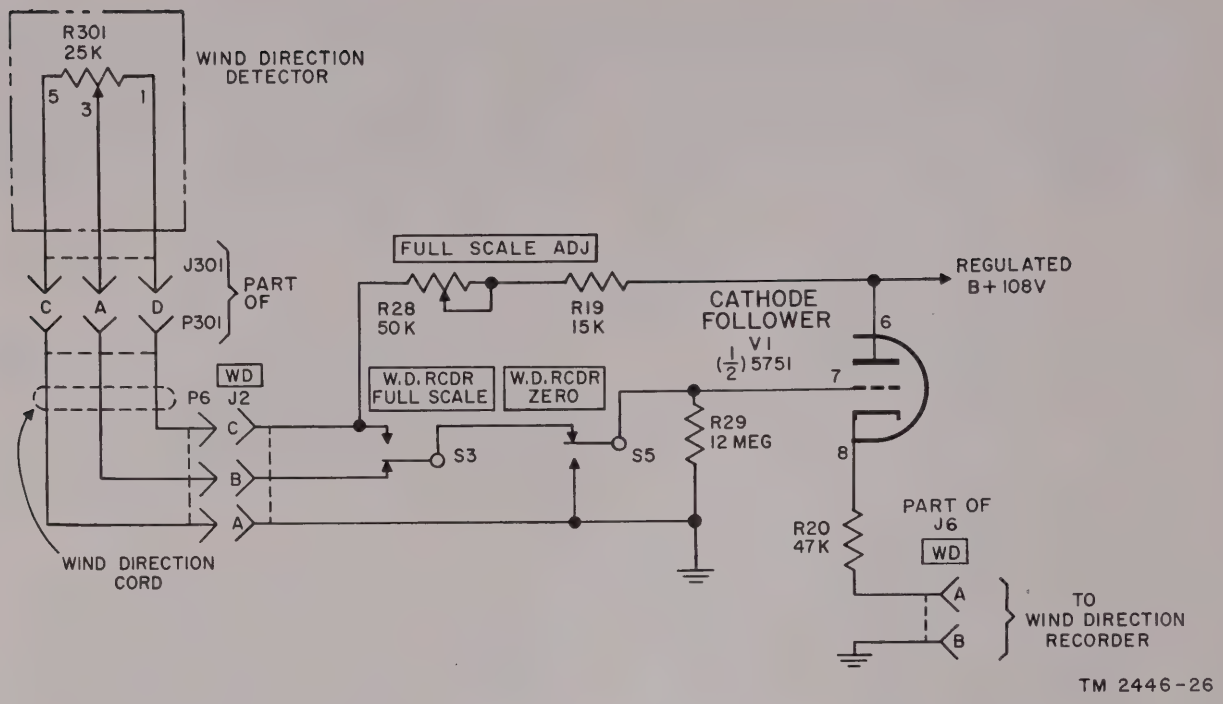


Figure 34. Wind direction detector and amplifier circuits, simplified schematic diagram.

Section IV. RECORDER

56. General

a. Wind Direction and Speed Recorder RO–64/GMQ–12 consists of a wind speed recorder and a wind direction recorder mounted on a common mounting chassis. Each recorder consists basically of a D'Arsonval ammeter in which a moving coil carries a pen. The pen records deflection data on a traveling paper chart. The moving coil rotates within a large permanent magnet. A vertical shaft to which the moving coil is connected, passes through the magnet. The pen element is contained in a fork on top of the shaft. A lever arm on the bottom of the shaft is used to manually adjust the pen point to a zero setting. Dc current transmitted by the amplifier-power supply energizes the coil, causing it to turn the shaft in a counterclockwise direction. The pen element connected to the shaft traces this movement on the chart paper.

b. Each recorder has a synchronous chart drive (electrically driven) and a spring chart drive. The wind speed recorder synchronous chart drive contains an electric motor for driving both synchronous chart drives. The wind speed recorder spring chart drive contains a spring motor for driving both spring chart drives. Each chart drive contains its own reroll motor.

57. Ammeter Circuits
(fig. 65)

a. Dc output from the switching circuit in the amplifier-power supply energizes the moving coil on ammeter M401, causing the shaft to turn and the pen element on the top of the shaft to move toward the right-hand margin of the chart. When the dc output is switched off, the moving coil pulls the shaft back toward the original position, and the pen element travels toward the left-hand margin of the chart. The result is an ink line on the chart corresponding to the rate at which the dc current is switched on and off in the amplifier-power supply.

b. Input energy to ammeter M401 is received from the amplifier-power supply through terminals A and B of WS TRANSLATOR connector J402.

c. Dc output from the current amplifier circuit in the amplifier-power supply energizes the moving coil in ammeter M501. Movement of the shaft causes the pen element on the top of the shaft to move to the right when the dc output increases and to the left

when the dc output decreases. The result is an ink line on the chart corresponding to the change in dc output delivered by the amplifier-power supply.

d. Input energy to ammeter M501 is received from the amplifier-power supply through terminals A and B of WD TRANSLATOR connector J502.

58. Chrono Pen Circuit
(fig. 65)

a. Each chrono pen assembly located in the upper right-hand corner of each recorder case consists of a pen and an inkwell. The inkwell rests in a hole in the bracket that attaches the chrono pen to the meter element. The back end of the pen has a fork that fits over the arm of the relay. Power for the relay is supplied from the amplifier-power supply circuit. The power for the wind speed recorder chrono pen relay enters the recorder at terminal C of connector J401 located on the back of the recorder chassis. The power for the wind direction recorder chrono pen relay enters the recorder at terminal C of connector J502 located on the back of the recorder chassis.

b. An external switch is installed and connected to the CHRONO connector J3 located on the back of the amplifier-power supply chassis. When the external chrono pen switch is closed, both chrono pen relays K402 and K501 are energized. This causes the pen to leave a mark approximately one-tenth of an inch long on the chart paper. If the switch is held closed, the relays remain energized for approximately 1 second, then they release for approximately 1 second, and will again energize. This chain of events continues as long as the external chrono pen switch remains closed. This 1 second make-break period is governed by capacitor C10 in the amplifier-power supply.

59. Synchronous Chart Drives
(figs. 35 and 36)

The wind speed synchronous chart drive contains an electric drive motor, an electric reroll motor, a gear shift relay, gears for driving the chart, and rollers for carrying the chart. It has a drive shaft that couples to a drive shaft in the wind direction synchronous chart drive. The drive motor in the wind speed synchronous chart drive produces the power for feeding the charts in both the wind speed and wind direction chart drives. The wind direction synchronous chart drive contains an electric reroll motor, gears for driving the charts, and rollers for carrying the charts.

a. Figure 35 shows how power is applied from the drive motor to the chart feed roller. The motor has a self-contained gearbox for changing the speed from per hour to per minute. Shifting of one speed to the other may be accomplished by energizing or deenergizing relay K401 (fig. 65). Relay K401 is energized by closing an external switch connected to terminals D and A of connector J403 located on the back of the recorder chassis. When relay K401 is energized, the armature strikes the arm of spring O 616, causing the gears to shift to the per minute feed position. When energy is removed from relay K401, spring O 616 forces the armature back and allows the gears to shift back to per hour speed. The shifting of the motor gears may also be accomplished mechanically by shifting a mechanical switch lever, HOUR FEEDS-MIN. FEEDS A 568, located on the right-hand side of the wind speed synchronous chart drive.

Note. Energizing relay K401 changes the speed only when HOURS FEEDS-MIN. FEEDS lever A 568 is set to HOURS FEEDS.

b. Motion is transmitted directly to the chart feed roller through the gear train arrangement shown in figure 36. The per inch rate of chart feed is governed by change gears O 520 and O 519 (par. 25).

c. Power for driving the chart feed roller in the wind direction synchronous chart drive is transmitted through a coupler attached between its drive shaft and the drive shaft in the wind speed synchronous chart drive. Motion is transmitted to the chart feed roller in exactly the same manner as in the wind speed synchronous chart drive (fig. 35).

d. Both chart drives have an electric reroll motor and a gear train designed to turn the reroll roller. Figure 36 shows how power is applied from the reroll motor to the reroll roller. During operation, 115-volt ac power is applied to the reroll motors through toggle switches S401 and S501. A gear on the reroll motor shaft turns gear O 595. Gear O 595 has a catch mounted on the outer surface which in combination with upper pawl O 619 prevents the gear from being turned in the reverse direction for more than 1 revolution. Motion is transmitted from gear O 595 through gear O 596 to the inner gear of clutch assembly O 597. Clutch assembly O 597 is a gear spring arrangement which has enough slipping action to prevent the reroll roller from pulling the

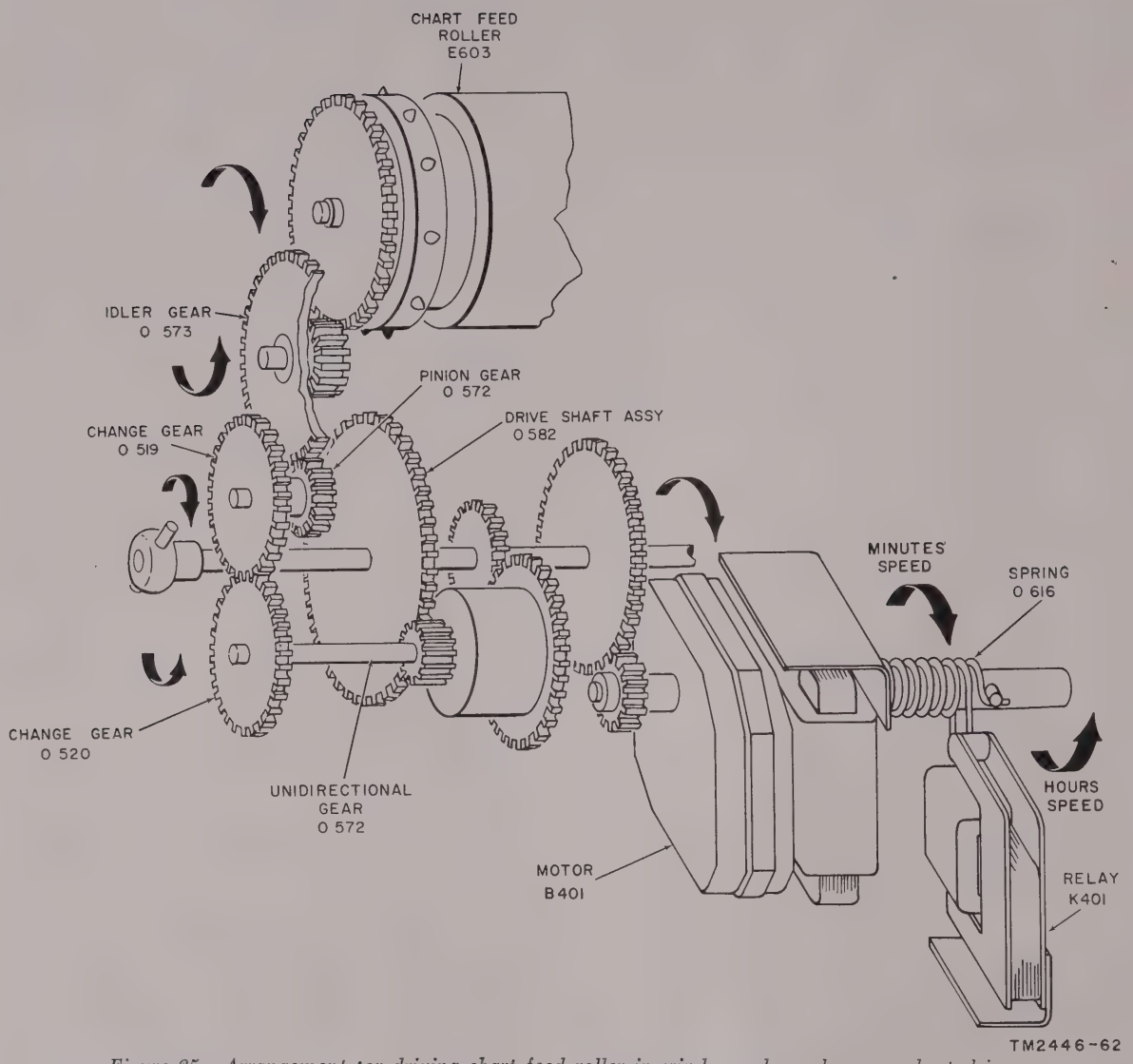


Figure 35. Arrangement for driving chart feed roller in wind speed synchronous chart drive.

chart faster than the chart feed roller is operating. Motion is transmitted by the outer gear of clutch assembly O 597 to clutch gear assembly O 620. Clutch gear assembly O 620 has a pawl catch that engages weighted pawl O 598 which prevents the reroll motor from turning the reroll roller unless a slight backward tension is applied to the reroll roller. The reroll roller motor cannot drive the reroll roller until the chart roll has been installed and tightened enough to apply a slight backward pressure. This releases weighted pawl O 598 and allows the reroll roller to turn. When the reroll motor is turned on, the reroll roller can be turned by hand by turning the reroll roller back about one-fourth of a turn, holding a slight tension on the roller and letting it slip in the hand. Clutch gear assembly O 620 also has a spring clutch that allows the reroll roller to be turned forward by hand.

e. Both synchronous chart drives operate from 110- to 125-volt ac, 60-cycle power. Ac power for the wind speed synchronous chart drive is obtained through pressure-type contacts from terminal board TB401 in the recorder case. Ac power for the wind direction synchronous chart drive is obtained through pressure-type contacts from terminal board TB501 in the recorder case.

60. Spring Chart Drives

(figs. 37 and 38)

The wind speed spring chart drive contains a double wound spring motor, a clock assembly, gears

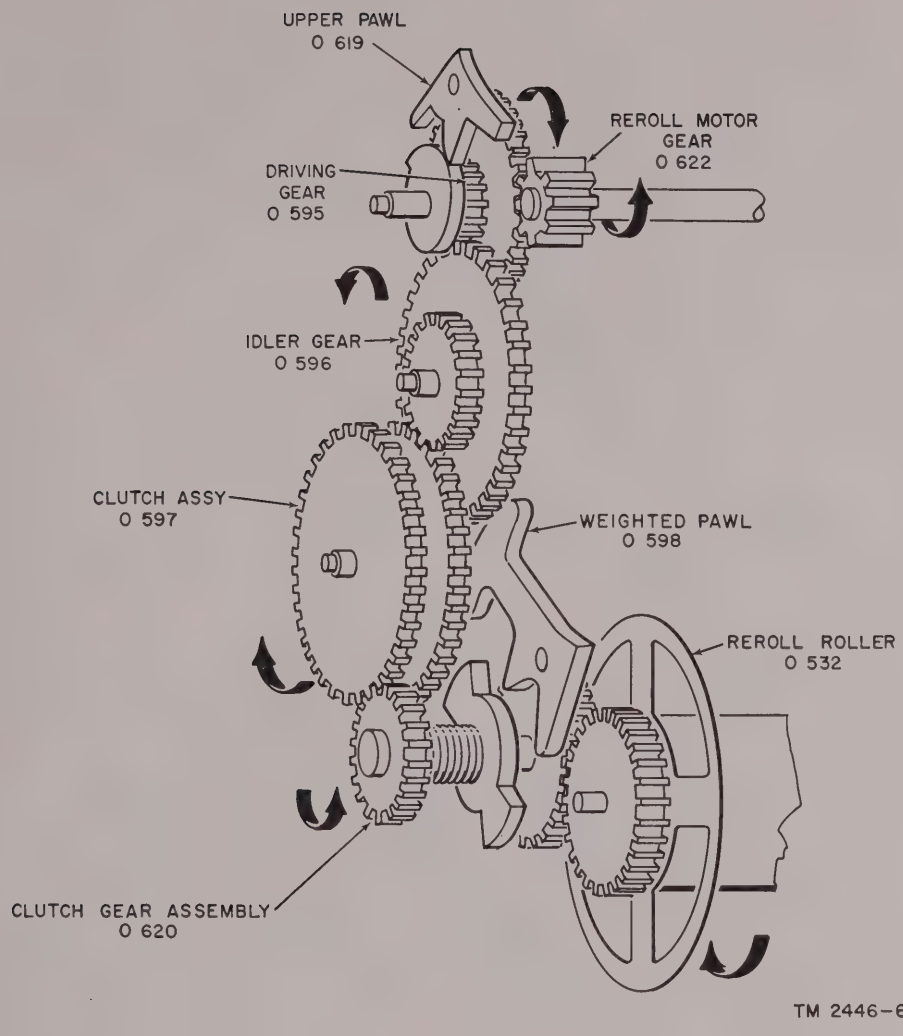


Figure 36. Arrangement for driving reroll roller in synchronous chart drives.

for driving the chart, and rollers for carrying the chart. It has a drive shaft that couples to a drive shaft in the wind direction spring chart drive. One of the springs in the double wound spring motor produces the power for feeding the charts in both the wind speed and wind direction chart drives. The wind direction spring chart drive has a spring wound reroll motor, gears for driving the chart, and rollers for carrying the chart.

a. Figure 37 shows how power is applied from the drive motor to the clock assembly and from there to the drive shaft. The two large gears and springs of the drive motor are mounted on concentric shafts so that the gears turn in opposite directions. The large gear on the motor turns in a clockwise direction and drives the clock assembly. The small gear on the motor turns in a counterclockwise direction and drives the reroll roller gear train assembly.

b. Motion is transmitted directly to the chart feed roller through the gear train arrangement as shown in figure 37. The per-inch rate of chart feed is governed by change gears O 521 and O 522. There are several possible combinations of these gears as explained in paragraph 25.

c. Power for driving the chart feed roller in the wind direction spring chart drive is derived from a coupler attached between its drive shaft and the drive shaft in the wind speed spring chart drive. Motion is transmitted to the chart feed roller in exactly the same manner as in the wind speed spring chart drive (fig. 37).

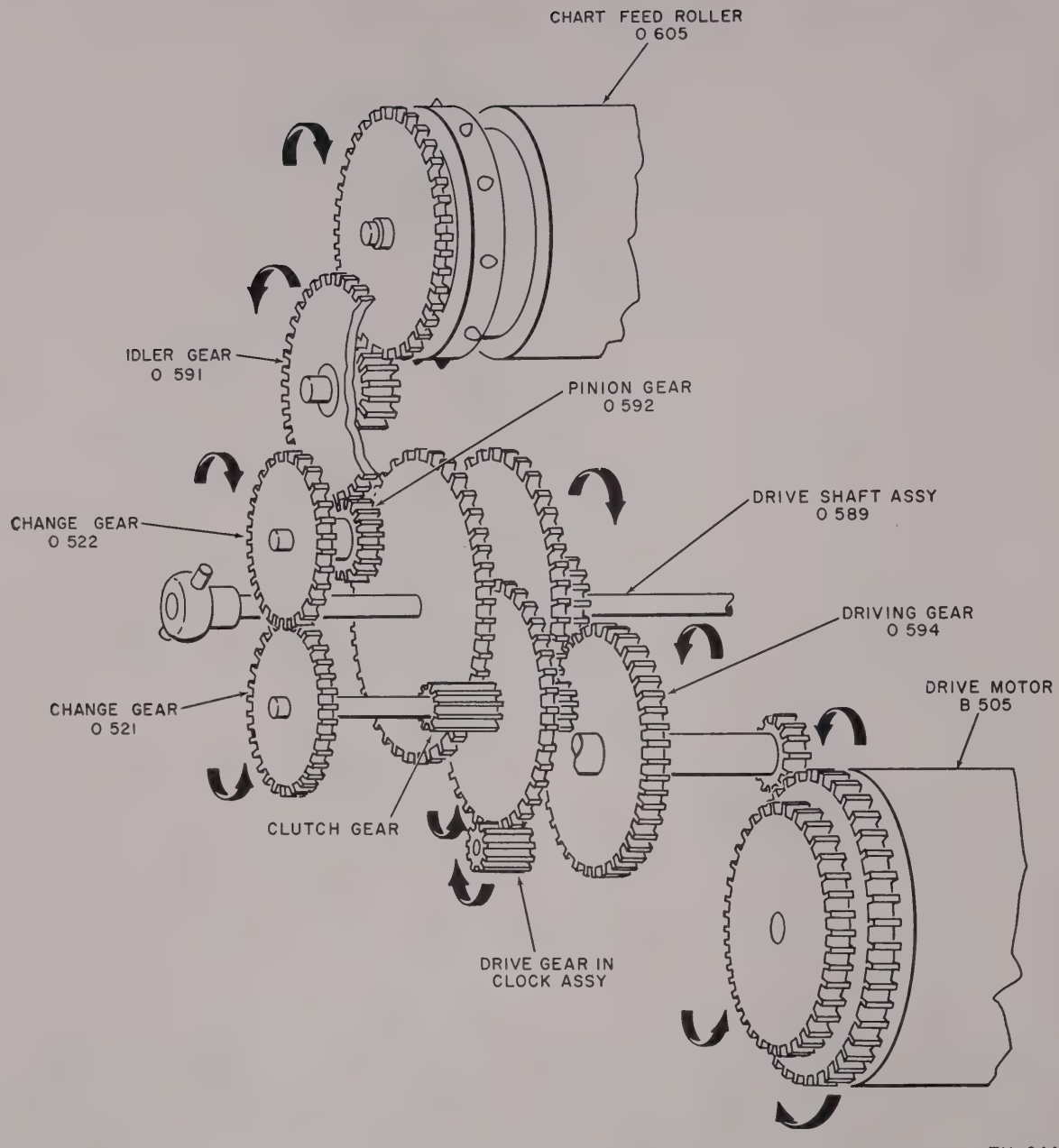


Figure 37. Arrangement for chart drive feed rollers in wind speed spring chart drives.

d. The reroll action of both chart drives is identical. Figure 38 shows how power is applied from the reroll motor to the reroll roller. Motion is transmitted directly from the reroll motor through the gear train to reroll drive gear assembly O 621. Reroll roller drive gear assembly O 621 has a pawl catch that engages weighted pawl O 599 which prevents the reroll motor from turning the reroll roller unless a slight tension is applied to the reroll roller. The reroll roller cannot turn unless the chart roll is installed and tightened enough to apply a slight backward pressure to the roller. It can be turned by hand by turning the roller back about one-fourth of a turn, holding a slight tension on the roller and letting it slip in the hand. Reroll roller drive gear assembly O 621 also has a spring clutch arrangement that allows the reroll roller to be turned forward by hand.

e. The MIN. FEEDS - HOUR FEED-STOP switch lever (fig. 20) turns both chart drives on or off and also selects the chart drive speed by changing the gear ratios inside the clock assembly.

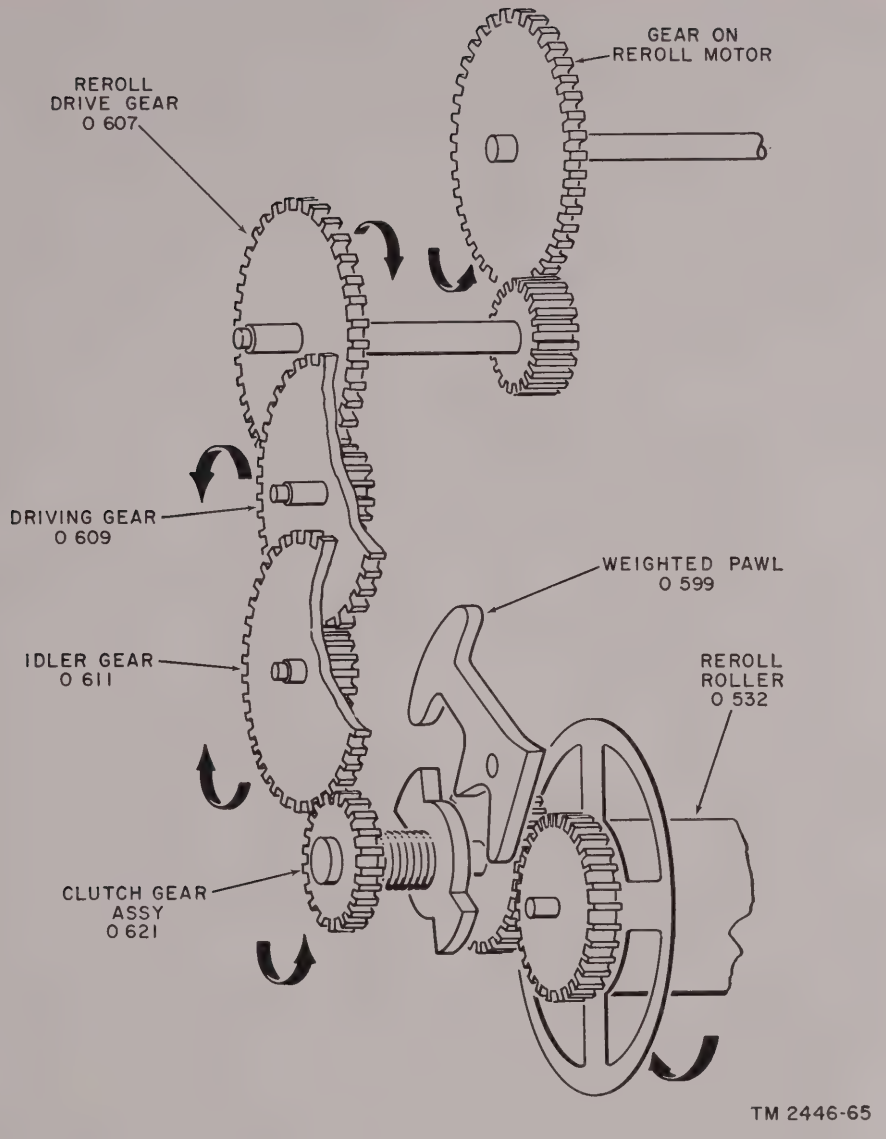


Figure 38. Arrangement for driving reroll roller in spring chart drives.

Section V. POWER SUPPLY AND VIBRATOR-INVERTER CIRCUIT

61. Power Supply
(fig. 39)

a. Ac power enters the amplifier-power supply through terminals A, B, and C of connector J4. The incoming ac is connected through fuse F1 and ON-OFF switch S1 to terminals 1 and 2 of the primary winding of power transformer T1. The voltage is stepped up in the high-voltage center tapped secondary winding and converted to dc by rectifier V6. Filament power for rectifier V6 is derived from terminals 6 and 7 of transformer T1.

b. Filter choke L1 in combination with capacitors C14A and C14B filters the unregulated output to rectifier V6.

c. Voltage regulator V5 provides regulated voltage for the operation of variable resistor R301 in the wind direction detector, cathode follower V1B in the wind direction amplifier circuit, and to the range correction resistors connected to switch S4. Resistor R22 limits the ionization current to voltage regulator V5. Capacitor C12 filters out ionization noise voltages generated by the tube.

d. Ac power is also applied to the primary windings, terminals 1 and 2, of transformer T2. The

secondary winding transformer T2 is connected in series with a filament winding of transformer T1 in order to double the filament voltage. The filaments of tubes V1 and V2 are powered by the filament winding of transformer T1. Tube V3 is powered by the filament winding of transformer T2.

e. The 12.6 volts developed by the series combination of the two filament windings of transformers T1 and T2 is rectified by bridge-connected selenium rectifier CR1. Capacitor C11 provides filtering for the rectifier. The dc from rectifier CR1 is applied to exciter lamp DS201 in the wind speed detector through a resistor, R26, R27 or R30, connected to cable impedance switch S2. The resistance used depends on the length and gage of the wind speed cord. If the cord is 20 AWG and is under 50 feet long, resistor R26 is used. If the cord is 20 AWG and is between 50 and 300 feet long, resistor R27 is used. If the cord is 20 AWG and is between 300 and 600 feet long, resistor R30 is used. For lengths longer than 600 feet, resistor R30 is used and the wire gage must be increased as the length increases.

f. The 12.6 volts developed by the series combination of the two filament windings of transformers T1 and T2 is applied through resistor R24 or R25 to selector switch S2 or directly to tube V202 in the wind speed detector. The resistance used depends on the length and gage of the wind speed cord. If the cord is 20 AWG and is under 50 feet long, resistor R24 is used. If the cord is 20 AWG and is between 50 and 300 feet long, resistor R25 is used. If the cord is 20 AWG and is between 300 and 600 feet, no resistor is used. For lengths longer than 600 feet, no resistor is used and the wire gage must be increased as the length increases.

g. Dc from rectifier CR1 is connected through voltage limiting resistor R23 to terminal A of CHRONO connector J3 for operation of the external chrono pen switch. Capacitor C10 stores energy for operating the chrono pens. It will store enough to energize the chrono pen relays in the recorders for approximately 1 second.

62. Vibrator-inverter Circuit

(fig. 66)

Vibrator-inverter PP–1689/GMQ–12 converts 6 volts dc to 117 volts, 60 cycles ac for the amplifier-power supply for use when ac power is not available.

a. The positive side of the 6 volts dc is connected through fuse F1 to the arm (4) of vibrator G1. The negative side is connected to the center taps (A3 and B3) of transformer T1. Current flows through the solenoid make-break contacts of the vibrator and energizes the solenoid when switch S1 is operated to ON. The vibrator arm is displaced by the magnetic field of the solenoid, which in turn causes separation of the solenoid make-break contacts. The vibrator arm then moves toward its original position. When the solenoid make-break contacts come together, the solenoid is reenergized. The vibrator arm is again displaced, but in the opposite direction from its initial displacement. The vibrator is thus alternately displaced in one direction and then in the other at a rate of 60 cycles per second.

b. When the vibrator arm is displaced in one direction, contacts 6 and 7 are connected to the positive pole of the battery. This causes current to flow in the lower halves of the two primary windings of transformer T1. The electromagnetic induction produced in the secondary winding of transformer T1 by the buildup of current in the two primary windings is additive. Each primary winding produces half of the induced secondary power.

c. When the vibrator arm is displaced in the opposite direction, contacts 1 and 2 are connected to the positive pole of the battery. This causes current to flow in the upper halves of the two primary windings. The electromagnetic induction produced by the buildup of current in the two primary windings is, as in *b* above, additive in the secondary winding.

d. Capacitor C1 bypasses radio frequencies which otherwise might pass into the battery circuit and radiate and cause interference. Capacitor C2 and resistor R1 form a spark suppression network for minimizing arcing between the solenoid make-break contacts of vibrator G1. When the solenoid make-break terminals open, a high counter electromotive force (cemf) is induced in the primary windings of transformer T1. The charging current which is produced in the spark suppression network dissipates power in resistor R1 which otherwise would produce arcing of the solenoid make-break contacts.

e. Buffer capacitors C3 and C4 short-circuit the high potential short duration transients which occur when the vibrator make-break contacts open. A much higher induced voltage results when the cir-

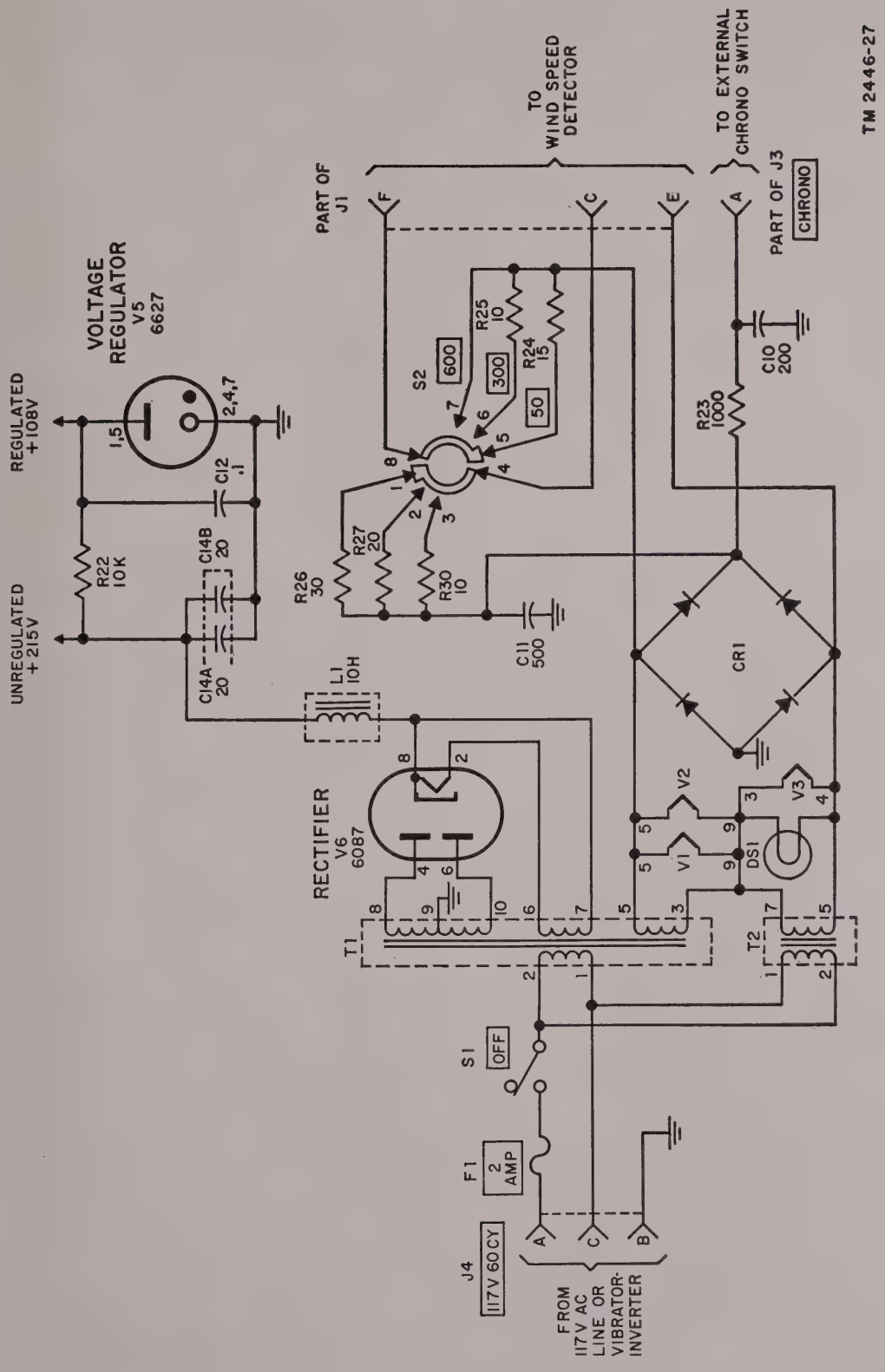


Figure 39. Power supply circuit, simplified schematic.

cuit to the primary windings of transformer T1 is broken than when this circuit is closed because the rate of change of current flow is greater.

f. Filter choke L1 and capacitors C5, C6, and C7 comprise a low pass filter for attenuating radio frequencies which might otherwise radiate from the 117-volt output circuit and cause interference.

g. Pilot lamp DS1 indicates presence of output voltage. Resistor R2 limits the current flow to lamp DS1.

CHAPTER 6

FIELD MAINTENANCE

Note. The amount of repair that can be performed by units having field maintenance responsibility is limited only by the tools and test equipment available and by the skill of the repairman.

Section I. GENERAL TROUBLESHOOTING TECHNIQUES

Warning: When servicing any part of the wind measuring set, be extremely careful of exposed high voltages. Disconnect the power cords from the recorder before removing the chart drives. Disconnect the wind direction and wind speed cords when removing the detector housing and reconnect, if necessary, after the housings have been removed.

63. Troubleshooting Techniques

a. General. To be effective, troubleshooting must be systematic. It is seldom possible to observe a troubel symptom and diagnose the cause immediately. Generally, it will be necessary to perform a *sequence* of operational checks, observations, and measurements before a fault will be revealed. For proper sequence, trace the trouble first to a unit, then to a portion of the unit, and finally to the defective part. The sequence of steps is referred to commonly as the sectionalization, localization, and isolation of trouble.

b. Sectionalization. The first aim when troubleshooting is to sectionalize the trouble to a unit of the wind measuring set. Determine the defective unit through visual checks or operational procedures (pars. 28–30) and through *additional* measurements and tests (pars. 88 and 89) as necessary.

c. Localization. After the defective unit is determined, make additional checks and measurements to localize the trouble to a portion of the unit. As in the case of sectionalization, use inspection, short-circuit checks, and operational techniques (par. 46) first, and use the specialized testing procedures (pars. 88 and 89) when necessary.

Caution: Do not apply power to the wind measuring set unless the operational symptoms are known and are of such a nature as to eliminate the possibility of further damage when power is applied. If the symptom is not known, or indicates the possible existence of short circuits, make cold resistance checks (figs. 40–42) before applying power.

d. Isolation. After trouble has been localized to a portion of a unit, for example to a stage or a group of functional related circuits, use visual inspection, voltage measurements, and resistance measurements to determine the defective part. Data and procedures for isolating defective parts are detailed in the troubleshooting chart (par. 66).

64. Tools, Materials, and Test Equipment Required

a. Tools and Materials.

Screwdriver, ¼-inch
Screwdriver, ⅛-inch
Open-end wrench, ⅝-inch
Open-end wrench, ¼-inch
Allen-head wrench, ⅛-inch
Allen-head wrench, $\frac{1}{16}$-inch
Antiseize compound (GLP)
Cloth, lint-free
Solvent, Dry Cleaning (SD)

b. Test Equipment Required.

Test Equipment	Technical manual	Common name
Multimeter TS–505/U	TM 11–5511	Multimeter
Audio Oscillator TS–382(*)/U	TM 11–2684A	Audio oscillator
Vacuum Tube Voltmeter ME–30/U	TM 9–5047–1	Vacuum tube voltmeter
Frequency Meter FR–67/U	TM 11–2698	Frequency meter
Electronic Multimeter TS–297/U	TM 11–5500	Electronic multimeter
Transforer CN–16A/U		Transformer

Section II. TROUBLESHOOTING AT FIELD MAINTENANCE LEVEL

65. General Precautions

Warning: The failure of selenium rectifiers can result in the liberation of poisonous fumes and the deposit of dangerous selenium compounds. If a rectifier burns out or arcs over, the odor is strong. Provide adequate ventilation immediately. *Avoid inhaling the fumes and do not handle the damaged rectifier until it has cooled.*

Observe the following precautions very carefully whenever servicing the wind measuring set:

a. When servicing the spring chart drives, release the tension on the spring motors. To do this, turn the reroll roller back approximately one-fourth of an inch and, at the same time, hold a slight tension on the roller so that it slips through the hand.

b. Be very careful when handling the wind speed and wind direction detectors. The bearings are extremely sensitive and may be damaged by even the slightest bump or unevenly applied torque. *Do not spin* the wind vane, anemometer, or rotating heads on the detectors by hand. Whenever the hose assembly is disconnected from the detectors, always screw in the plugs to prevent dirt from entering the units.

c. Do not disturb capacitors C5A, C5B, C6A, C6B, C6C, C7A, C7B, C7C, C8A, C8B, C8C, or resistor R18 unless it definitely has been determined that the trouble is caused by these components (par. 88).

66. Troubleshooting Chart

The following chart is supplied as an aid in locating trouble in the wind measuring set. It lists the symptoms which the repairman observes, either visually or audibly, while making a few simple tests. The chart also indicates how to localize trouble quickly to a major circuit or mechanical assembly. After the trouble has been localized to a stage or circuit, a check of voltage and resistance measurements of this stage should be sufficient to isolate the defective parts. Normal voltage and resistance readings for the amplifier-power supply and the wind speed detector are given in figures 40 through 42. Individual components of the amplifier-power supply and the vibrator-inverter are shown in figures 43 through 47. Normal transformer and coil resistance readings for the amplifier-power supply and the vibrator-inverter are given in paragraph 67.

a. Wind Speed Circuit.

Symptom	Probable cause	Remedy
1. Wind speed pen element remains on extreme left-hand line of chart when wind measuring set is operating.	1. No ac power.	1. Check ac power.
	Blown fuse F1 in amplifier-power supply.	Replace (fig. 12).
	Defective fuse F1 in vibrator-inverter (if used).	Check and replace (fig. 13).
	Defective vibrator G1.	Replace (fig. 46).
	Cable impedance switch S2 improperly set.	Increase or decrease setting (fig. 12).
	Wind speed cord too long or improper wire gage.	Replace (par. 61*e* and *f*).
	Defective connector J402, P402, P5, J5, P4, J4, P201, J201, P1, or J1.	Replace (fig. 65).

Symptom	Probable cause	Remedy
	Defective tube V6.	Check and replace (fig. 43).
	Defective exciter lamp DS201.	Check and replace (par. 89*c*).
	Defective phototube V201.	Check and replace (par. 89*c*).
	Defective tube V202, V1, V2, V3, or V4.	Replace defective tube (fig. 43).
	Defective transformer T3.	Replace (fig. 43).
	Defective rectifier CR1.	Replace (fig. 44).
	Defective switch S2 or S4.	Replace defective switch (fig. 43).
	Defective meter M401.	Check and replace (par. 71).
	Open CR2.	Replace (fig. 44).
	Shorted CR3.	Replace.
	Shorted capacitor C9.	Replace.
	Defective capacitor or resistor in wind speed circuit.	Make voltage and resistance checks and replace defective capacitor or resistor (fig. 40 through 42).
2. Wind speed recorder shows erratic readings such as pen element moving rapidly back and forth across chart when anemometer is rotating slowly.	2. Shorted CR2.	2. Replace (fig. 44).
	Open CR3.	Replace.
	Shorted capacitor C13.	Replace.
	Defective tube V3 or V4.	Replace (fig. 43).
	Defective capacitor C5A, C5B, C6A, C6B, C6C, C7A, C7B, C7C, C8A, C8B, or C8C.	Replace defective capacitor (par. 88).
3. Wind speed pen element remains at full scale for one position of the MAX. RANGE MPH switch, but not on other positions.	3. Defective capacitor C5A, C5B, C6A, C6B, C6C, C7A, C7B, C7C, C8A, C8B, or C8C.	3. Replace defective capacitor (par. 88).
4. Wind speed pen element indicates an abnormally high reading for each position of the MAX. RANGE MPH switch.	4. Resistor R18.	4. Replace with a resistor of smaller value (par. 88).
5. Wind speed pen element indicates an abnormally low reading for each position of the MAX. RANGE MPH switch.	5. Resistor R18.	5. Replace with a resistor of larger value (par. 88).

b. Wind Direction Circuit.

Symptom	Probable cause	Remedy
1. Wind direction pen element remains on extreme left-hand line when wind vane is moving.	1. Defective tube V1 or V5.	1. Replace defective tube (fig. 43).
	Open resistor R20 or R22.	Replace defective resistor (fig. 45).
	Shorted capacitor C12.	Replace (fig. 44).
	Defective connector J2, P2, P502, or J502.	Replace defective connector.
	Defective meter element in wind direction recorder.	Check and replace meter (par. 71).
2. Wind direction pen element remains at full scale deflection when wind vane is moving.	2. Terminal 5 of resistor R301 open.	2. Repair connection (par. 70).
	Defective connector P301, J301, P6, or J6.	Replace connector.
3. Wind direction pen element does not rest on the exact centerline of the chart when the mark on the rotating head is lined up with the mark on the drive shaft.	3. Wind speed recorder not adjusted properly.	3. Adjust recorder (par. 20*d*).
	Resistor R301 not adjusted properly.	Adjust resistor R301 (par. 91*b*).
	Resistor R19 or R28 open.	Replace defective resistor (fig. 45).
	W.D. RCDR ZERO, and W.D. RCDR FULL SCALE controls not adjusted properly.	Adjust controls (par. 20*c*).

c. Synchronous Chart Drives.

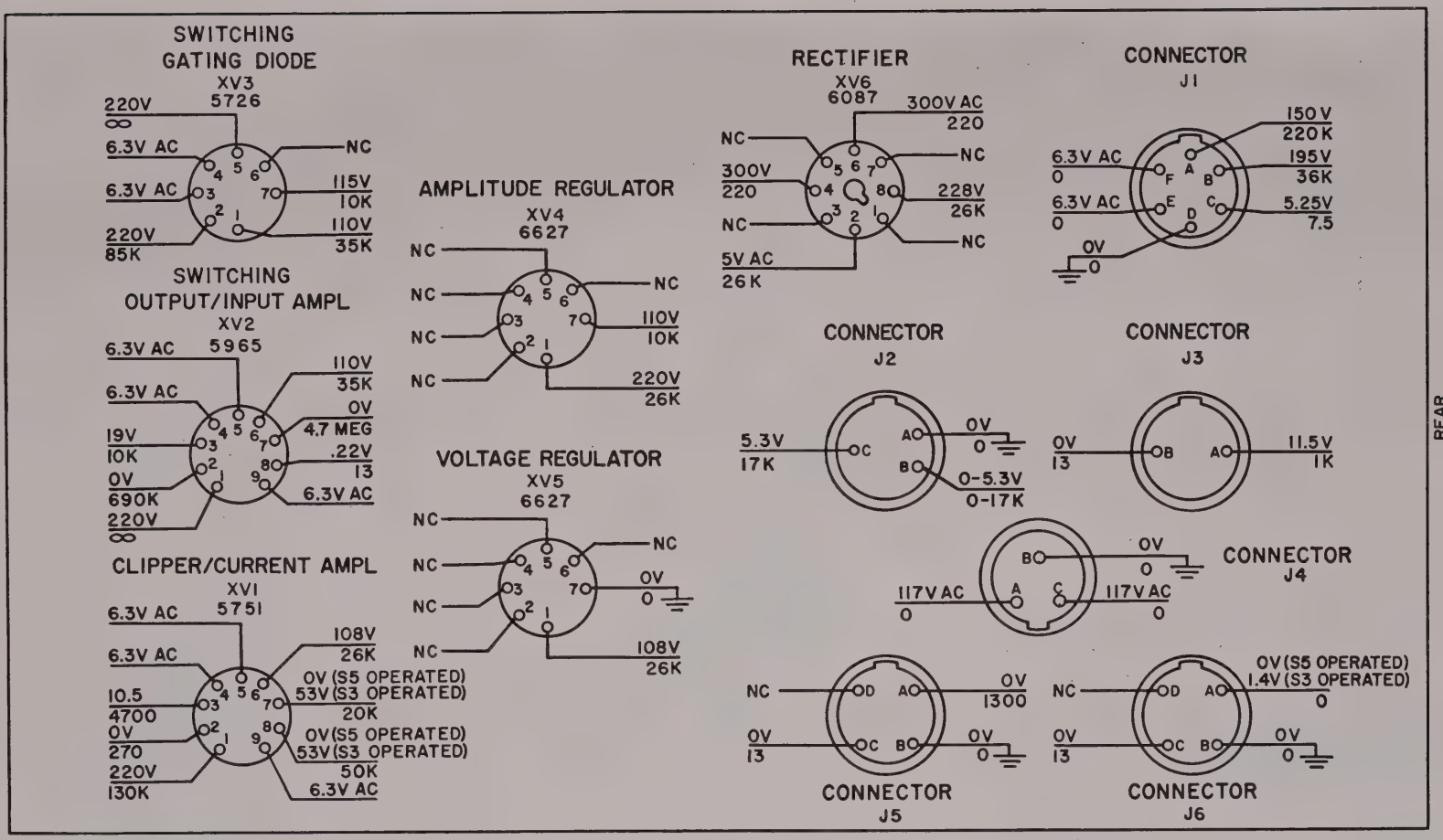
Symptom	Probable cause	Remedy
1. Power is applied to recorder but chart drive will not run.	1. Contacts at back of chart drive not making contact or shorted.	1. Check the pointed contacts on the back of the chart drive.
	Defective wiring.	Check all wiring connections (fig. 69).
	Retaining screws loose on front panel.	Tighten the retaining screws securely.
	Defective drive motor B401.	Check and replace motor (par. 81*a*).
	Worn or bent drive gears.	Check the gears associated with the drive shaft (par. 72).
2. Reroll roller does not turn when chart drive is operating.	2. Not enough tension on reroll roller.	2. Adjust tension (par. 26).
	Defective reroll motor.	Check and replace (par. 71).
	Worn or bent gears in reroll gear train.	Check the pawl catch in the lower section of gear train (par. 72).
3. Chart drive will not switch from hours to minutes feed, or vice versa, when HOUR FEEDS-MIN. FEEDS switch is changed.	3. Defective gearbox in drive motor B401.	3. Replace (par. 72).
Chart drive will not switch from hours to minutes feed when chart speed switch is closed.	Defective switch or connecting cord.	Check switch and the connecting cord (fig. 17).
	Defective relay K402.	Check and replace (par. 72).
Chart drive does not feed chart at correct rate.	Gear or shaft out of alinement in drive gear train.	Disassemble the drive gear train and inspect all gears, bushings, and shafts (par. 72).
	Drive motor defective.	Replace.
4. External chart drive motor does not drive chart at correct speed.	4. Defective gear in external chart drive motor.	4. Check and replace any defective gear, shaft, or bushing (par. 84).
	Defective motor B1001.	Replace (pars. 76 and 85).

d. Spring Chart Drives.

Symptom	Probable cause	Remedy
1. Chart drives will not run when wound and set at MIN. FEEDS or HOUR FEEDS.	1. Worn or bent drive gears.	1. Check and replace gears (par. 73).
	Clock assembly defective.	Replace (par. 73).
	Spring motor defective.	Replace (par. 73).
2. Reroll roller does not turn when chart drive is operating.	2. Not enough tension on reroll roller.	2. Adjust tension (par. 26).
	Worn or bent gear or shaft in reroll gear train.	Check and replace defective gear (par. 75).
3. Chart drive does not feed at correct rate.	3. Gear or shaft out of alinement in drive gear train.	3. Check and replace any defective gea. shaft, or bushing (par. 73).

e. Vibrator-inverter (figs. 46 and 47)

Symptom	Probable cause	Remedy
1. Battery connected, switch S1 in ON position, vtvm connected across the terminals of J1 reads 0 volt ac.	1. Fuse F1 defective.	1. Replace.
	Shorted capacitor C1.	Replace.
	Defective battery.	Check and replace.
	Vibrator G1 defective.	Replace.
	Defective buffer capacitor C3 or C4.	Replace defective capacitor.
	Defective capacitor C7.	Replace.
	Open reactor L1.	Replace.
	Defective transformer T1.	Replace.
2. Battery connected, switch S1 in ON position, vtvm connected across terminals of J1 reads less than 117 volts ac.	2. Vibrator G1 defective.	2. Replace.
	Capacitor C2 defective.	Replace.
	Capacitor C3, C4, or C7 defective.	Replace defective capacitor.
	Transformer T1 defective.	Replace.

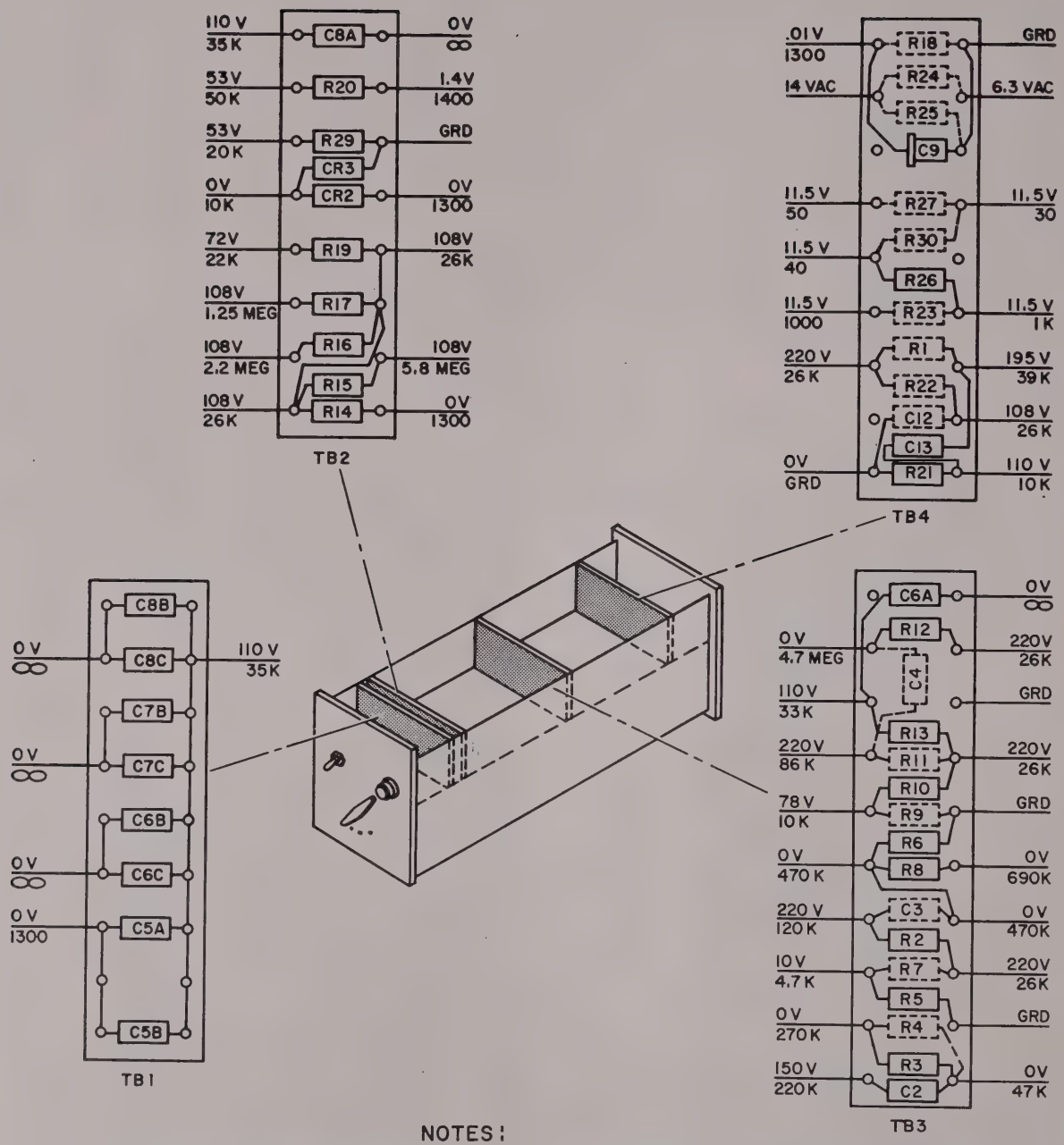


NOTES:

1. VOLTAGE READINGS ABOVE LINE, RESISTANCE READINGS BELOW LINE.
2. VOLTAGES TAKEN WITH WIND SPEED AND DIRECTION DETECTORS CONNECTED. EXCITER LAMP DS201 IN WIND SPEED DETECTOR REMOVED FROM SOCKET. SWITCH S2 SET AT 50. SWITCH S4 SET AT 60.
3. VOLTAGES ARE DC UNLESS OTHERWISE SPECIFIED.
4. VOLTAGES AND RESISTANCES MEASURED TO GROUND WITH A 20,000-OHMS-PER-VOLT METER. USE HIGHER METER RANGES TO PREVENT LOADING.
5. NC INDICATES NO CONNECTIONS.

TM 2446-36

Figure 40. Amplifier-power supply, tube socket and connector voltage and resistance diagram.



NOTES:

1. VOLTAGE READINGS ABOVE LINE, RESISTANCE READINGS BELOW LINE.
2. VOLTAGES TAKEN WITH WIND SPEED AND WIND DIRECTION DETECTORS CONNECTED. EXCITER LAMP DS201 IN WIND SPEED DETECTOR REMOVED FROM SOCKET.
   SWITCH S2 SET AT 50.
   SWITCH S3 OPERATED.
   SWITCH S4 SET AT 60.
3. VOLTAGES AND RESISTANCES MEASURED TO GROUND WITH A 20,000-OHMS-PER-VOLT METER. USE HIGHER METER RANGES TO PREVENT LOADING.
4. VOLTAGES ARE DC UNLESS OTHERWISE SPECIFIED.

TM 2446-37

Figure 41. Amplifier-power supply, terminal board voltage and resistance diagram.

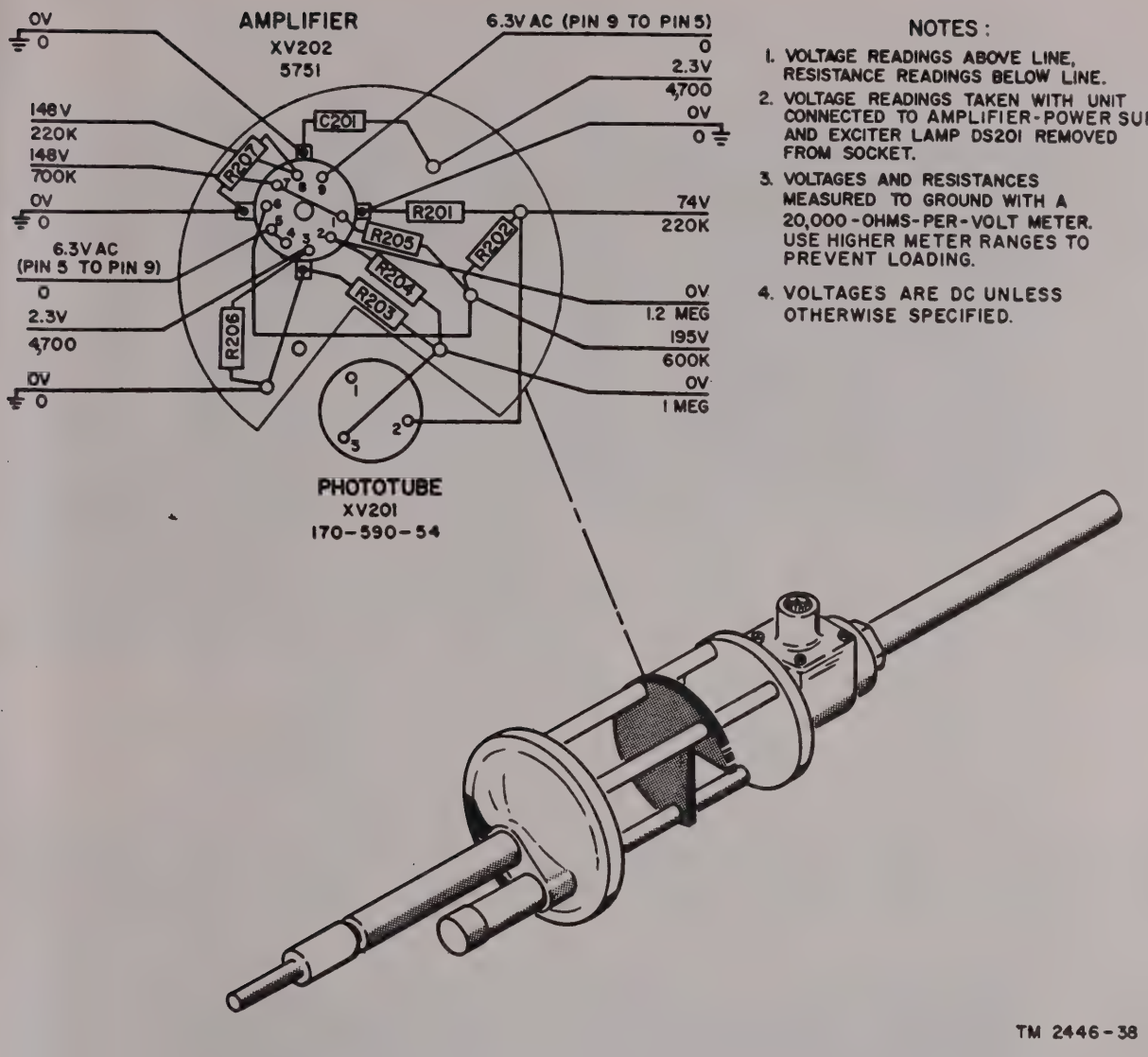


Figure 42. Wind speed detector, voltage and resistance diagram.

67. Dc Resistance of Transformers and Coils

a. Amplifier-power Supply (fig. 44). The dc resistances of the transformer windings and coils in the amplifier-power supply are listed below:

Transformer or coil	Terminals	Ohms
	8–9	220
	9–10	220
T1	6–7	Less than 1
	3–5	Less than 1
	1–2	2
T2	1–2	6
	5–7	Less than 1
T3	1–2	13
	3–4	26
L1	1–2	400

b. Vibrator-inverter (figs. 46 and 47). The dc resistances of the transformer windings and coils in the vibrator-inverter are listed below:

Transformer or coil	Terminals	Ohms
	A1–A2	Less than 1
	A2–A3	Less than 1
T1	A4–A5	5
	B1–B3	Less than 1
	B3–B5	Less than 1
L1	1–2	Less than 1
	3–4	Less than 1

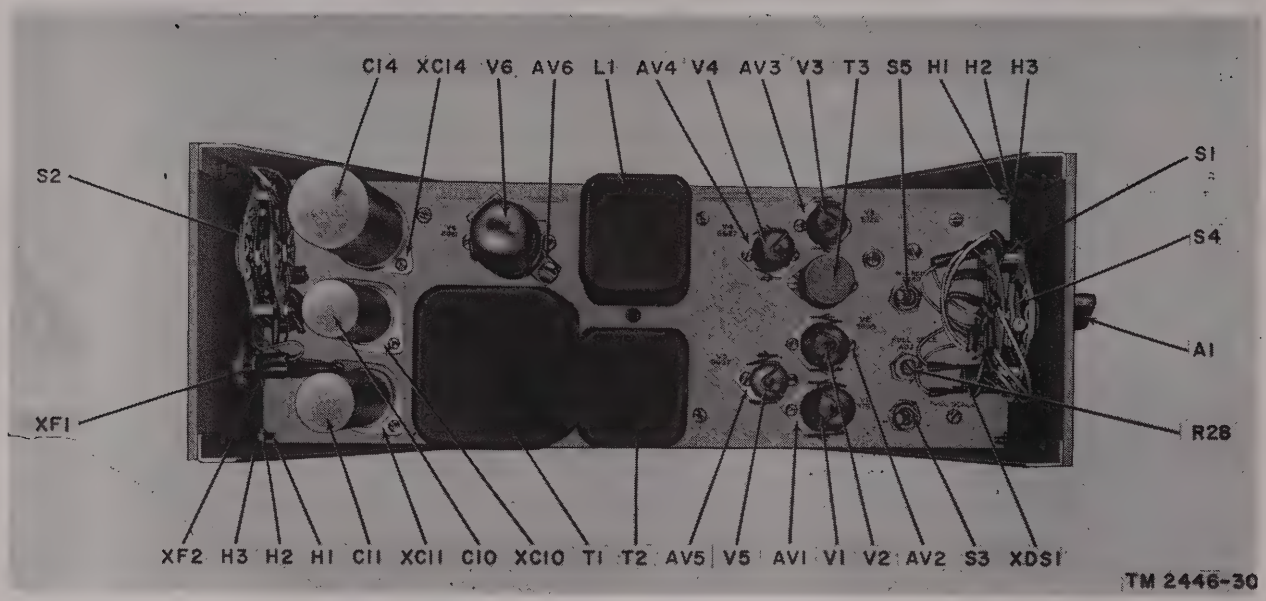

C14 XC14 V6 AV6 L1 AV4 V4 AV3 V3 T3 S5 H1 H2 H3
S2
S1
S4
A1
XF1
R28
XF2 H3 H2 H1 C11 XC11 C10 XC10 T1 T2 AV5 V5 AV1 V1 V2 AV2 S3 XDS1
TM 2446-30

Figure 43. Amplifier-power supply, top view, housing removed.

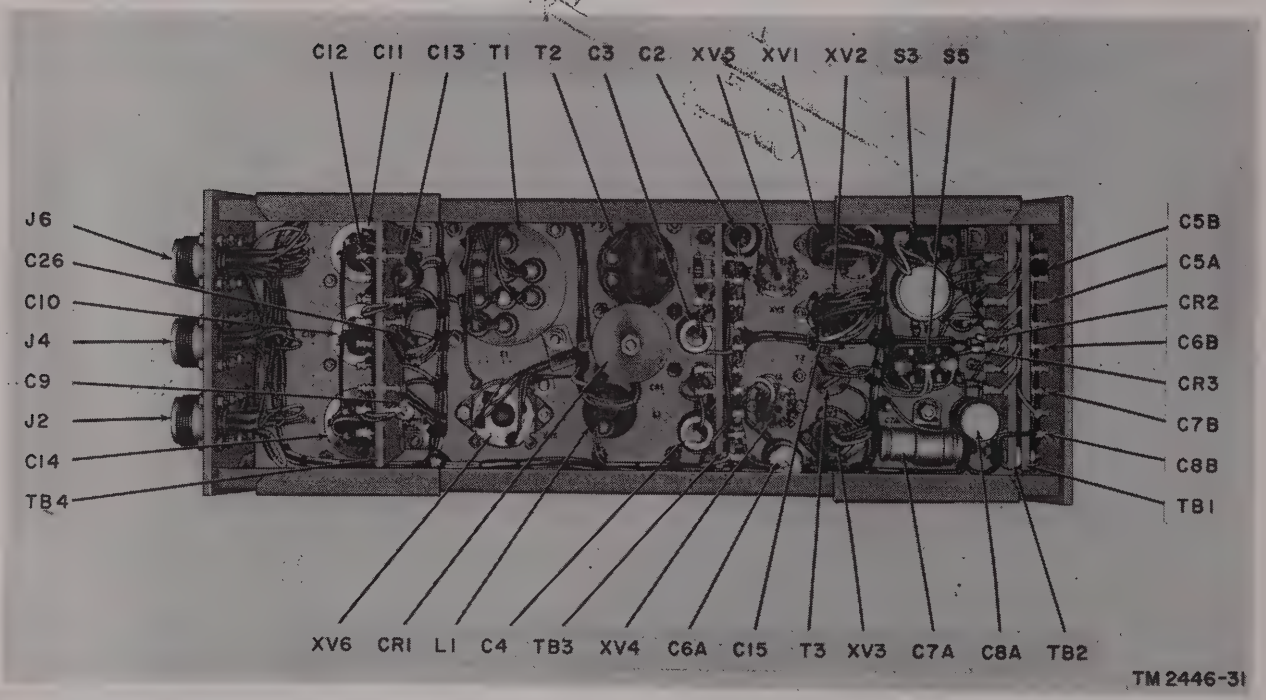


Figure 44. Amplifier-power supply, location of electrical components (less resistors), bottom view.

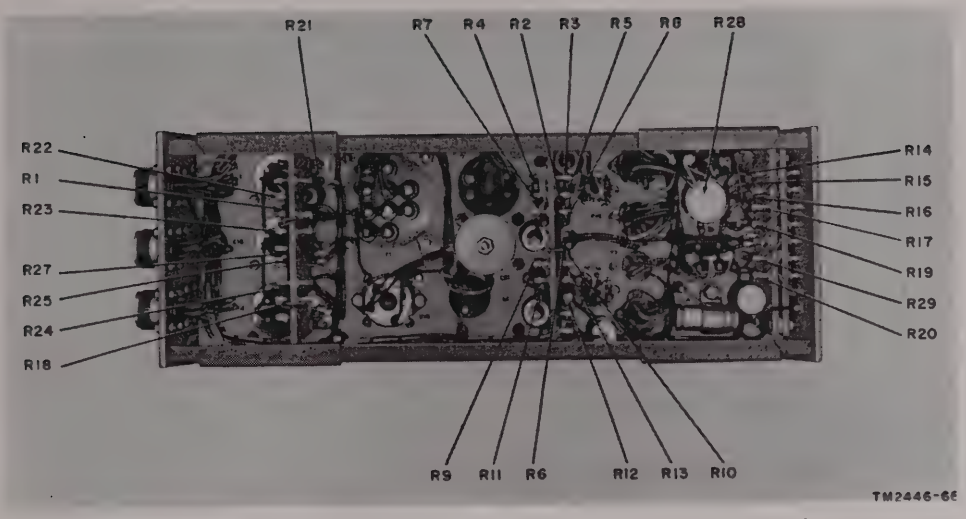


Figure 45. Amplifier-power supply, location of resistors, bottom view.

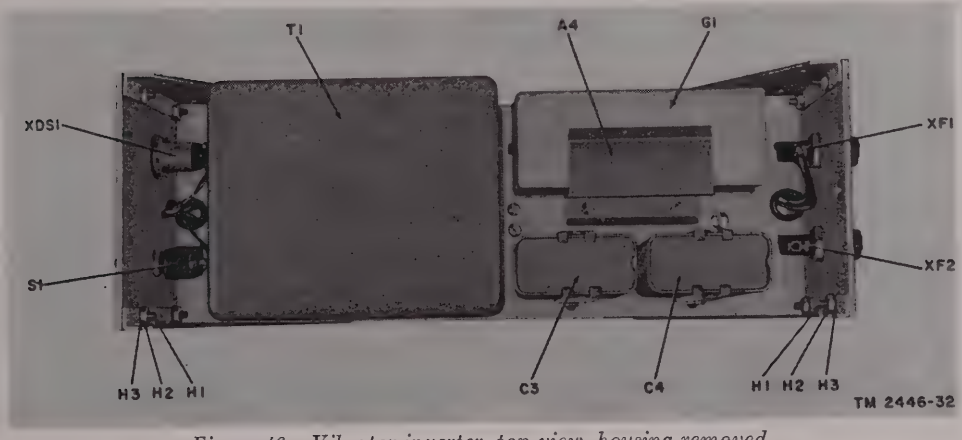


Figure 46. Vibrator-inverter, top view, housing removed.

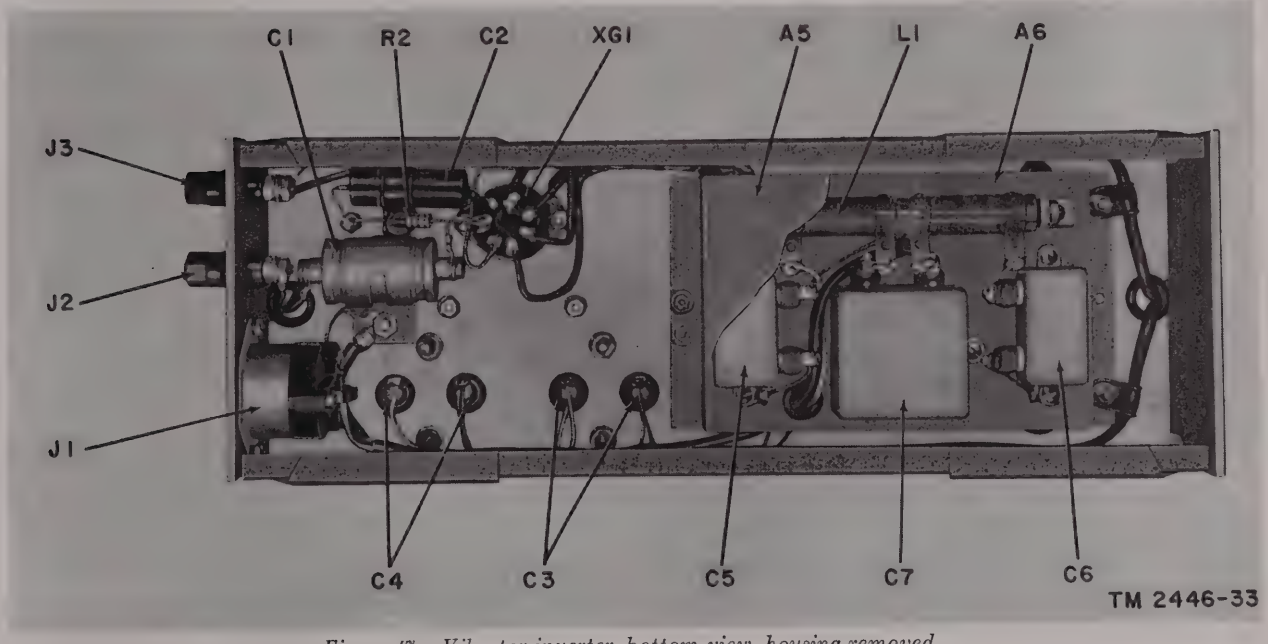


Figure 47. Vibrator-inverter, bottom view, housing removed.

68. Disassembly of Equipment

Complete instructions for the disassembly of the equipment are contained in paragraphs 68 through 77. The symbol numbers for each part are included in the legends for the referenced figures. Trouble-shooting procedures should localize the defect to a particular malfunctioning stage or assembly, thereby eliminating the necessary for disassembling the equipment completely for repairs.

69. Disassembly of Wind Speed Detector (figs. 48 and 49)

Note. Do not disassemble the wind speed detector (fig. 48) unless *absolutely* necessary. It is very difficult to aline the light chopper and drive shaft.

a. Hold the rotating head firmly and pull out the anemometer (1, fig. 49). Unscrew the lamp holder housing (2). Remove the lamp (3) and the setscrew (4). The contact spring (5) and the lamp retainer (6) will now drop out of the bottom of the lamp holder housing (2). Lift the contact (7) out of the lamp retainer (6). Remove the gasket (8).

b. Loosen the screws (43), push the slide fasteners (46) inward, and slide the housing cover (9) off the lower end of the housing assembly. Remove the gasket (48) from the groove on the inside of the housing cover (9).

c. Remove the phototube (10) and the tube (11) from their sockets.

d. Loosen the locknut (12) and unscrew the tubular shaft (13). Unscrew the plug (14) from the tubular shaft (13).

e. Remove the screws (15) and the lockwashers (16). Unscrew the lower supports (17) by inserting a ⅛-inch diameter or smaller rod in the hole in the center of each support and turning counterclockwise.

f. Remove the light chopper plate (20) by removing the screws (18) and the lockwashers (19). Loosen the screws (21) and remove the light chopper (22). Unscrew the drive shaft assembly (23) and remove the gasket (24).

Caution: Handle the drive shaft assembly (23) with extreme care. The bearings in the rotating head may be seriously damaged by even the slightest bump. *Do not spin* the rotating head by hand. Do not attempt any further disassembly of the drive shaft.

g. Remove the screw (25) and the lockwasher (26). Push the lamp holder mount (27) out of the bottom of the top housing (30). Unsolder the wiring connections to the lamp holder mount (27).

h. Unscrew the upper supports (28) by inserting a ⅛-inch diameter or smaller rod in the center hole of each support and turning counterclockwise. Remove the gasket (29) from the top housing (30).

i. Swing the tube chassis (31) to one side and unsolder the wiring connections from the connector plug (39). Remove the tube retainer (35) by removing the screws (32), the lockwashers (33), and the nuts (34). Remove the phototube socket (36) by unsoldering the wiring connections.

j. Remove the screws (37) and the lockwashers (38) that retain the connector plug (39). Pull the connector with the attached wiring out of the bottom housing (47). Remove the connector gasket (40) and unsolder the wiring connections to the connector plug (39).

k. Remove the cotter pin (41) and the washer (42) from the end of each screw (43). Remove the screws (43), the springs (44), the washers (45), and the slide fasteners (46) from the bottom housing (47).

70. Disassembly of Wind Direction Detector (figs. 50 and 51)

Note. Do not disassemble the wind direction detector (fig. 50) unless *absolutely* necessary. It is very difficult to aline the variable resistor, drive shaft assembly, and the sighting bar (par. 91*d*).

a. Hold the rotating head firmly and pull out the wind vane (1, fig. 51).

b. Remove the screw (2), the metal washer (3), the rubber washer (4), the metal washer (5), the sighting bar (6), and the metal washer (7) from the collar (8). Slide the collar off the tubular shaft (11).

c. Loosen the screws (21) and push the slide fasteners (25) inward. Slide the housing cover (9) off the housing assembly.

d. Loosen the locknut (10) and unscrew the tubular shaft (11). Unscrew the plug (12) from the bottom of the tubular shaft (11).

e. Unsolder the wiring connections to the variable resistor (32). Remove the screws (13) and the lockwashers (14) and pull the connector plug (15) with

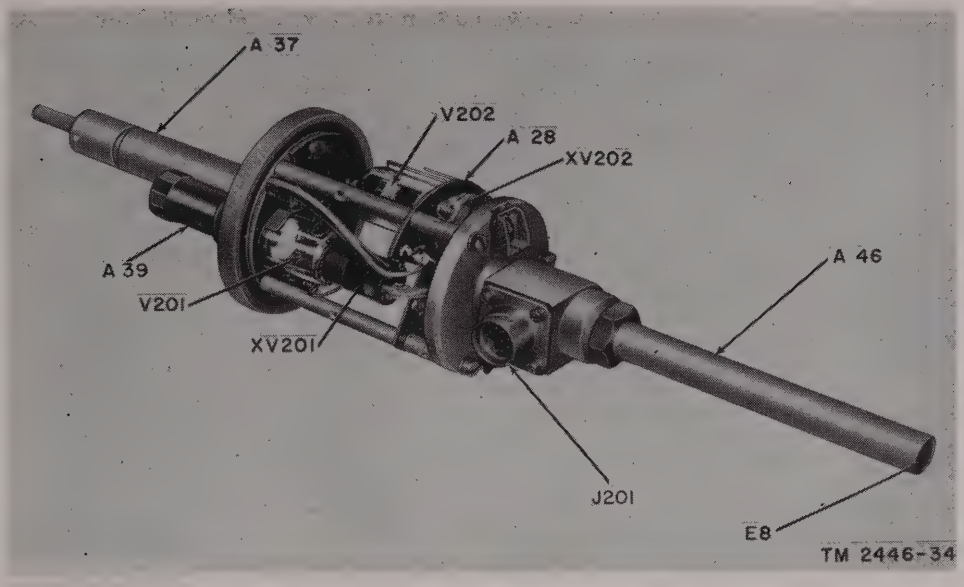


Figure 48. Wind speed detector, cover removed.

the attached wiring out of the bottom housing (19). Remove the gasket (16) from the connector plug (15) and unsolder the wiring connections.

f. Remove the bottom housing (19) by removing the screws (17) and the lockwashers (18). Remove the cotter pins (20) and unscrew the screws (21). Remove the washers (22), the springs (23), the washers (24), and the slide fasteners (25).

g. Remove the supports (26) by unscrewing them from the studs in the top housing (36). Loosen the supports by inserting a ⅛-inch diameter or smaller rod through the holes in the center and turning in a counterclockwise direction.

h. Remove the resistor mount (29) by removing the screws (27) and the lockwashers (28). Remove the variable resistor (32) from the resistor mount (29) by removing the nut (30) and the lockwasher (31).

i. Unscrew the mount spacers (33) from the studs in the top housing (36).

j. Unscrew the drive shaft assembly (34) from the top housing (36) and remove the gasket (35).

Caution: Handle the drive shaft assembly (34) with extreme care. The bearings in the rotating head will be seriously damaged with even a slight bump. *Do not* attempt further disassembly of the drive shaft assembly (34). *Do not spin* the rotating head by hand.

k. Remove the gasket (37) from the top housing (36).

l. Remove the gasket (38) from the inside of the housing cover (9).

71. Disassembly of Recorder
(fig. 52)

Note. The only difference between disassembly of the wind direction recorder and the wind speed recorder is that the terminal board (46) in the wind direction recorder has only one connector.

a. Complete disassembly of the recorder includes removing and disassembly the chart drives and all of the parts contained in or attached to the cases and mounting chassis. Disassembly of the synchronous chart drives is outlined in paragraph 72. Disassembly of the spring chart drives is outlined in paragraph 73.

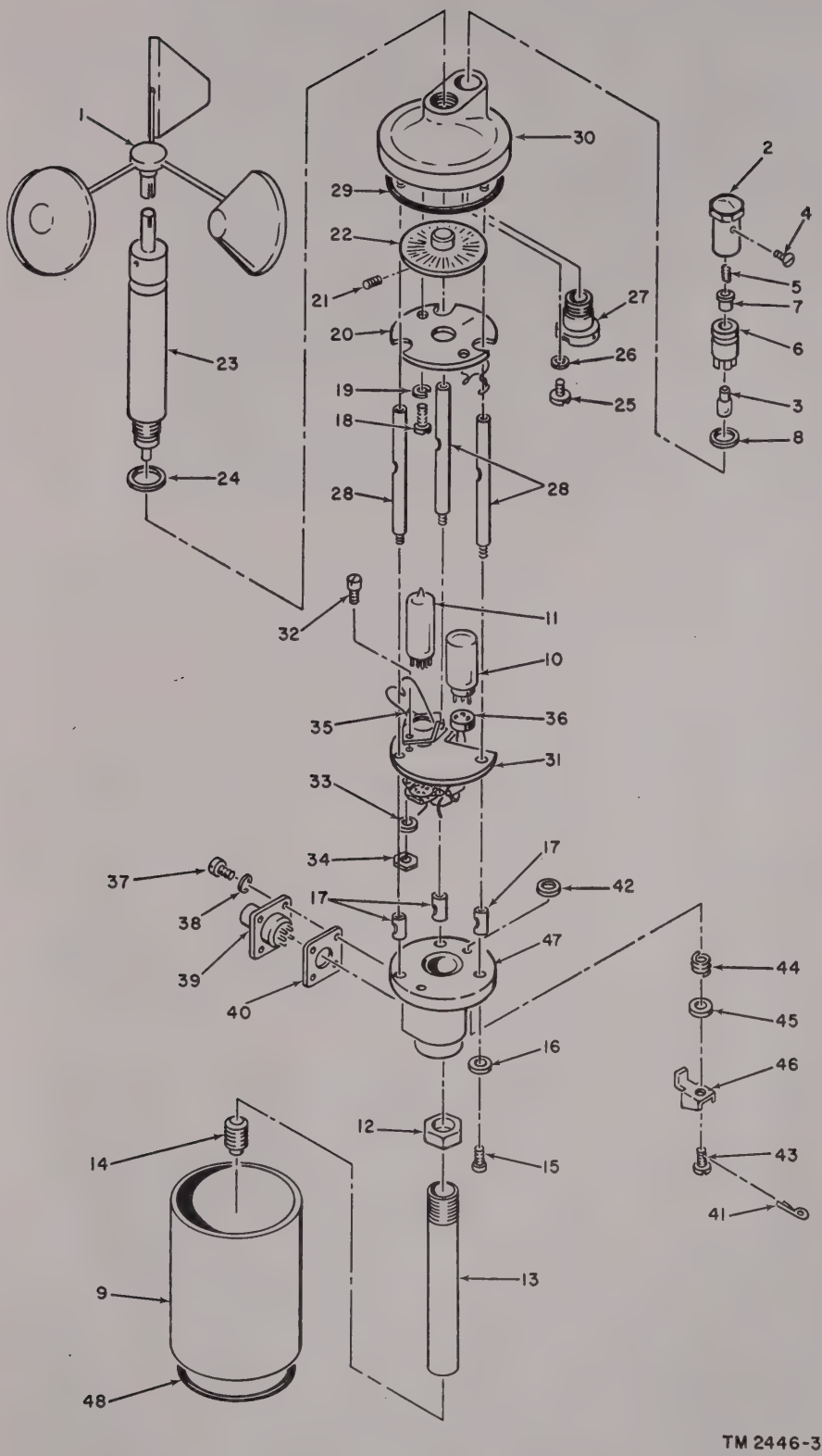
b. Remove the chart drives and disassemble the recorder cases and mounting chassis as follows:

(1) Twist the cover latch (5) and open the wind speed recorder case cover approximately 3 inches. Push the bottom of the cover in toward the case approximately three-eighths of an inch and lift the case cover (1) out of its hinges.

(2) Remove the cover latch (5) by removing the screw (2), the cap nut (3), and the washers (4).

(3) Lift out the chrono pen (6), the pen element (7), and the inkwell (8).

Caution: Be careful not to spill the ink out of the inkwell on the equipment.



1 Anemometer (A 36)
2 Lamp holder housing (A 39)
3 Lamp (DS201)
4 Setscrew (H33)
5 Contact spring (O 15)
6 Lamp retainer (A 60)
7 Contact (A 61)
8 Gasket (E12)
9 Housing cover (A 40)
10 Phototube (V201)
11 Tube (V202)
12 Locknut (H34)
13 Tubular shaft (A 46)
14 Plug (E8)
15 Screw (H35)
16 Lockwasher (H36)
17 Lower support (O 9)
18 Screw (H37)
19 Lockwasher (H38)
20 Light chopper plate (A 45)
21 Screw (H39)
22 Light chopper (A 29)
23 Drive shaft assembly (A 37)
24 Gasket (A 1005)
25 Screw (H40)
26 Lockwasher (H41)
27 Lamp holder mount (A 43)
28 Upper support (O 12)
29 Gasket (O 4)
30 Top housing (A 32)
31 Tube chassis (A 28)
32 Screw (H42)
33 Lockwasher (H43)
34 Nut (H44)
35 Tube retainer (A 27)
36 Phototube socket (XV201)
37 Screw (H45)
38 Lockwasher (H46)
39 Connector plug (P201)
40 Connector gasket (O 2)
41 Cotter pin (H47)
42 Washer (H48)
43 Screw (H49)
44 Spring (O 16)
45 Washer (H50)
46 Slide fastener (E4)
47 Bottom housing (A 33)
48 Gasket (O 5)

Figure 49. Wind speed detector, exploded view.

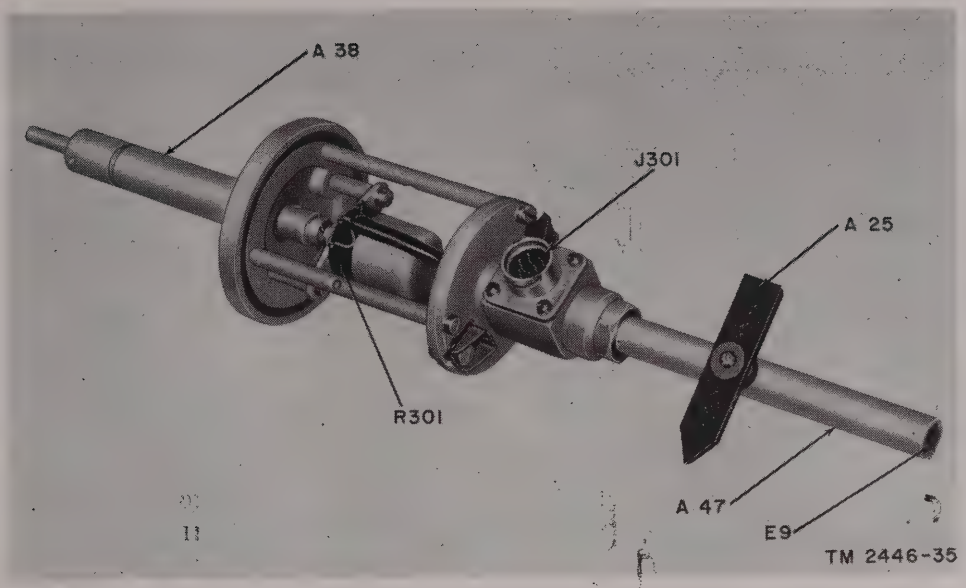


Figure 50. Wind direction detector, cover removed.

(4) Remove the screw (9) and the washer (10). Move the chrono pen relay bracket (36) approximately one-fourth of an inch to the left.

(5) Disconnect the shaft coupler (11) from the drive shaft knob by prying it to the left with a screwdriver.

(6) Loosen the screws (12) and pull the wind speed chart drive (13) straight out of the case.

(7) Remove the screws (14) and lift off the cover hinges (15).

(8) Remove the nameplate (17) and the bracket (18) by removing the screws (16).

(9) Remove the back panel (20) by removing the screws (19).

(10) Remove the terminal board (24) by removing the screws (21), the nuts (22), and the washers (23). Swing the terminal board out of the front of the case and remove the screws (25) and the lockwashers (26) that attach the connector (27). Remove the lock ring (28) from the connector (27). Push the terminal insert out of the connector and unsolder the wires from the terminals.

(11) Remove the screws (29), the screw (30), the nut (31), and the lockwasher (32) and lift out the meter element (33).

(12) Remove the relay bracket (36) from the meter element by removing the screws (34) and the lockwashers (35).

(13) Remove the relay (38) from the relay bracket (36) by removing the screws (37). Remove the mounting bracket (39). Unsolder wiring connections to the relay (38).

(14) Remove the screws (40) and the lockwashers (41) and lift out the contact board (42). Unsolder wiring connections to the contact board.

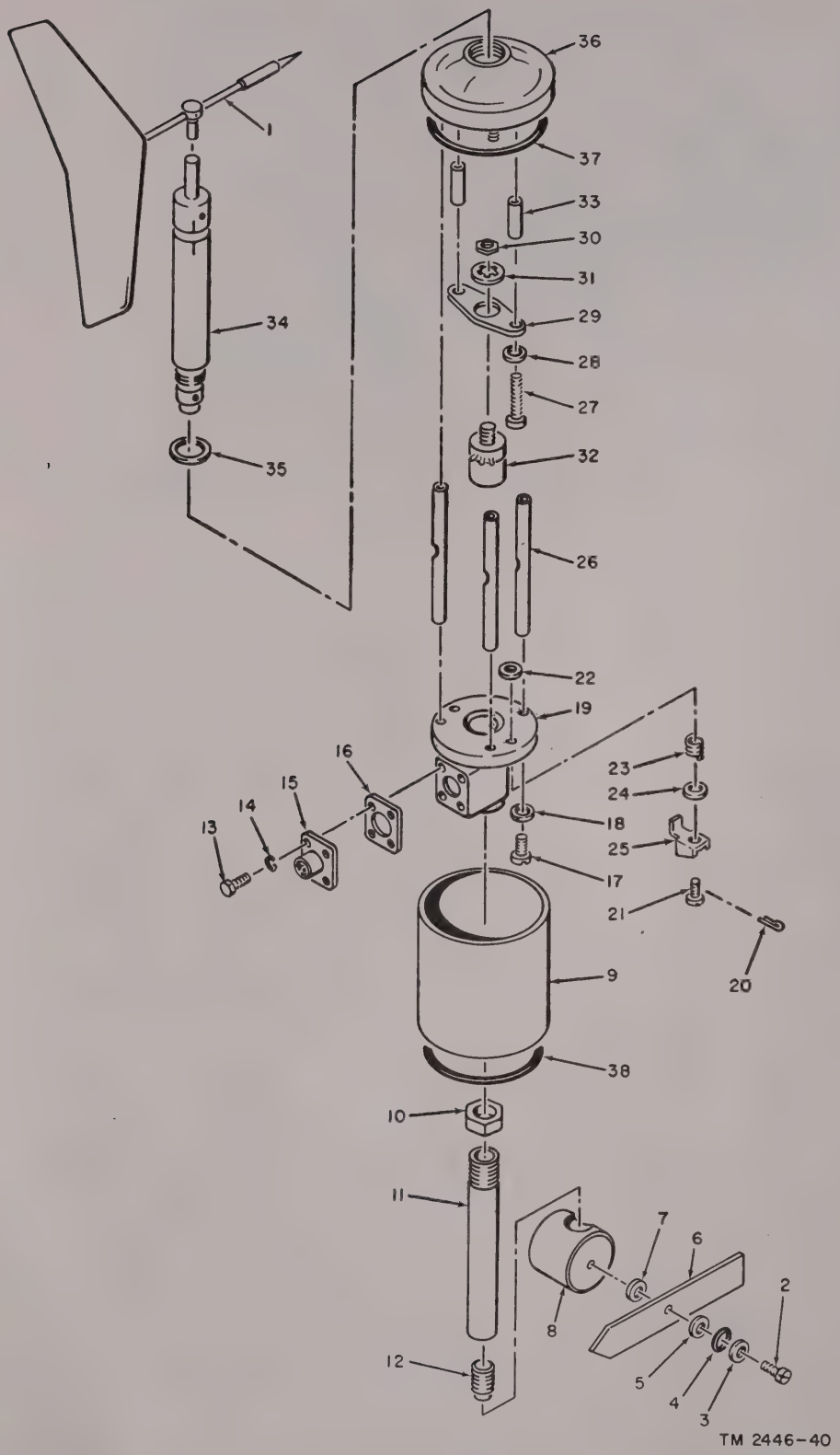
(15) Remove the terminal board (46) by removing the screws (43), the nuts (44), and the lockwashers (45).

(16) Remove the screws (47) and the lockwashers (48) that attach the connectors (49 and 50). Remove the lock rings from the back of the connectors, push the terminal insert out of each connector, and unsolder the wiring connections.

(17) Remove the screws (51), the nuts (52), and the lockwashers (53) that attach the carrying handle (54).

(18) Remove the capnuts (55), the screws (56), the nuts (57), and the lockwashers (58).

(19) Remove the case (61) from the mounting chassis (62) by removing the screws (59) and the lockwashers (60).



1 Wind vane (A 54)
2 Screw (H20)
3 Metal washer (A 53)
4 Rubber washer (A 52)
5 Metal washer (A 56)
6 Sighting bar (A 25)
7 Metal washer (A 57)
8 Collar (A 30)
9 Housing cover (A 41)
10 Locknut (H21)
11 Tubular shaft (A 47)
12 Plug (E9)
13 Screw (H22)
14 Lockwasher (H23)
15 Connector plug (P301)
16 Gasket (O 3)
17 Screw (H24)
18 Lockwasher (H25)
19 Bottom housing (A 34)
20 Cotter pin (H26)
21 Screw (H27)
22 Washer (H28)
23 Spring (O 18)
24 Washer (H29)
25 Slide fastener (E6)
26 Support (A 1002)
27 Screw (H30)
28 Lockwasher (H31)
29 Resistor mount (A 44)
30 Resistor nut (O 1)
31 Lockwasher (H32)
32 Variable resistor (R301)
33 Mount spacer (A 1000)
34 Drive shaft assembly (A 38)
35 Gasket (A 1006)
36 Top housing (A 35)
37 Gasket (O 6)
38 Gasket (O 7)

Figure 51. Wind direction detector, exploded view.

(20) Remove the front and top window glasses (65 and 66) by removing the clips (64) and the screws (63). Remove the latch screw (68) by removing the nut (67).

Note. The window glass cannot be removed without breaking it unless the cement is removed with a heated putty knife.

(21) Remove the rubber bumper (70) by unscrewing the shaft (69) from the right-hand side of the case cover (1). Remove the rubber gasket (71) from the inside edge of the case cover (1).

(22) Pull the shaft (72) out of the bottom of the meter element (33). Unscrew the bushing nut (73) and remove the lockwashers (74) and the zero adjustment lever (75).

(23) Unscrew the shaft bushing nut (76) from the bottom of the case (61).

72. Disassembly of Synchronous Chart Drives

Do not completely disassemble the synchronous chart drives unless absolutely necessary. Most troubles in the chart drives will be caused by careless handling. Be very careful when handling the gears and shafts so that they will not be bent or knocked out of alinement.

a. Wind Speed Synchronous Chart Drive (fig. 53).

(1) Remove the screws (1) and remove the instruction plate (2).

(2) Remove the scale (3) by lightly springing the ends toward each other and lifting the scale out of the chart drive.

(3) Remove the corner chart mounting screws (4).

(4) Remove the chart drive change gear clip (5) by lifting it up and out of the change gear bracket (8).

(5) Remove the change gear bracket (8) from the left-hand side plate (109) by removing the screws (6) and the washers (7).

(6) Remove the change gears (10, 11, 12, and 13) by removing the knurled nut (9) from the shaft of the change gear clip (5).

(7) Press down on the left- and right-hand reroll latches (17 and 20) and remove the reroll roller (14) by pulling it up and out of the chassis slots.

(8) Remove the left-hand reroll latch (17) from the reroll gear train assembly (43) by removing the screws (15) and the washer (16). Remove the right-hand reroll latch (20) by removing the screws (18) and the washer (19).

(9) Remove the chart supply arbor (21) by lifting it up and pulling it forward out of the chart drive.

(10) Remove the left- and right-hand chart guides (23 and 24) by removing the screws (22) that attach each chart guide.

(11) Remove the guide forks (26) by removing the screw (25) that attaches each fork.

(12) Remove the top drive roller plate (28) by removing the screws (27).

(13) Remove the adjusting brackets (30) by removing the screws (29).

(14) Remove the left- and right-hand pen bumpers (32 and 33) by removing the screws (31).

(15) Remove the two knurled nuts (34) and remove the change gears (35 and 36).

(16) Remove the drive gear cover (38) by removing the screws (37).

(17) Pull off the drive gear plate (39), the pinion gear (40), and the idler gear (41).

(18) Remove the screws (42) that retain the reroll gear train assembly (43). Lift the reroll gear train assembly carefully away from the chart drive. Disassemble the reroll gear train assembly (par. 74).

(19) Remove the left-hand supply arbor bracket (45) by removing the screws (44). Remove the spring (46) from the left-hand supply arbor bracket.

(20) Remove the right-hand supply arbor bracket (48) by removing the screws (47). Remove the spring (49) from the right-hand supply arbor bracket.

(21) Loosen the setscrew (50) and remove the set knob (51).

(22) Remove the screws (52) and slide the bushing (53) off the drive roller shaft. Lift up the right-hand end of the drive roller (54) and remove the drive roller.

(23) Drive the pin (55) out of the coupler knobs (56) from each end of the drive shaft assembly (88).

(24) Remove the screw (57) that attaches the chart guide plate (64) to the right-hand side plate (62).

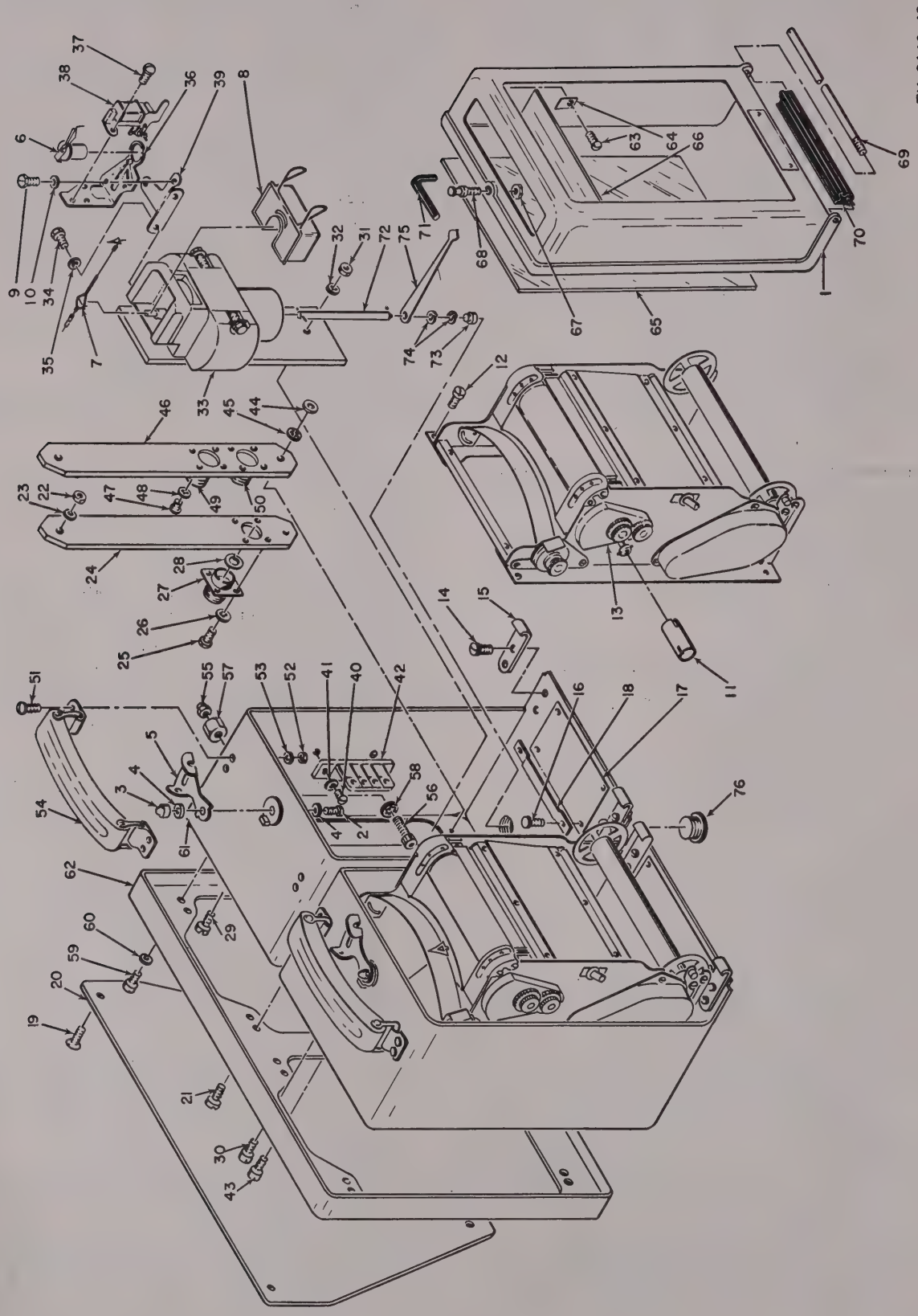


Figure 52. Recorder, exploded view.

1 Case cover (E506)
2 Screw (H501)
3 Capnut (H502)
4 Washer (H503)
5 Cover latch (E509)
6 Chrono pen (E571)
7 Pen element (E573)
8 Inkwell (E574)
9 Screw (H504)
10 Washer (H505)
11 Shaft coupler (O 502)
12 Corner screw (H506)
13 Wind speed chart drive
14 Screw (H507)
15 Cover hinge (H508)
16 Front screw (H509)
17 Nameplate (N501)
18 Bracket (H510)
19 Screw (H511)
20 Back panel (E504)
21 Screw (H512)
22 Nut (H513)
23 Washer (H514)
24 Terminal board (TB502)
25 Screw (H515)
26 Lockwasher (H516)
27 Connector (J402)
28 Lock ring (H517)
29 Screw (H518)
30 Screw (H519)
31 Nut (H520)
32 Lockwasher (H521)
33 Meter element (M401)
34 Screw (H522)
35 Lockwasher (H523)
36 Relay bracket (H524)
37 Screw (H525)
38 Relay (K402)
39 Mounting bracket (A 585)
40 Screw (H526)
41 Lockwasher (H527)
42 Contact board (TB401)
43 Screw (H528)
44 Nut (H529)
45 Lockwasher (H530)
46 Terminal board (TB402)
47 Screw (H531)
48 Lockwasher (H532)
49 Connector (J403)
50 Connector (J401)
51 Screw (H533)
52 Nut (H534)
53 Lockwasher (H535)
54 Carrying handle (A 501)
55 Capnut (H536)
56 Screw (H537)
57 Nut (H538)
58 Lockwasher (H539)
59 Screw (H540)
60 Lockwasher (H541)
61 Case (A 505)
62 Mounting chassis (A 503)
63 Screw (H542)
64 Clip (H543)
65 Glass (A 507)
66 Glass (A 509)
67 Nut (H544)
68 Latch screw (H545)
69 Shaft (H548)
70 Rubber bumper (A 587)
71 Gasket (A 588)
72 Shaft (H549)
73 Bushing nut (H546)
74 Lockwasher (H547)
75 Zero adjustment lever (H588)
76 Shaft bushing nut (H589)

Figure 52—Continued.

(25) Remove the screw (58) that attaches the chart roller plate (66) to the right-hand side plate (62).

(26) Remove the screws (59) that attach the right-hand side plate (62) to the upper and lower bar of the backplate (85). Remove the screws (60) that attach the top mounting plate (70) to the right-hand side plate (62). Remove the two screws (61) that attach the lower mounting plate (73) to the right-hand side plate (62) and lift off the side plate.

(27) Remove the screw (63) and remove the chart guide plate (64). Remove the screw (65) and remove the chart roller plate (66). Push the chart roller (67) to one side and remove from the chart roller plate (66).

(28) Remove the screws (68) from the left-hand side plate (109) and the screws (69) in the backplate (85). Lift off the top mounting plate (70).

(29) Remove the screw (71) from the left-hand side plate (109) and the screws (72) from the backplate (85). Unsolder the wiring connections to the terminal blocks (82). Lift off the lower mounting plate (73).

(30) Slide the roller (74) to one end and remove it from the top mounting plate (70). Slide the roller (75) to one end and remove it from the lower mounting plate (73).

(31) Loosen the locknut (76). Remove the knurled nut (77) and remove the switch plate (78) and switch (79). Unsolder the switch wiring connections.

(32) Remove the screw (80) that attaches the left-hand side plate (109) to the backplate (85).

(33) Remove the screw (81) that attaches each terminal block (82) to the backplate (85). Remove the terminal blocks (82).

(34) Remove the screw (83) and separate the motor mount (86) from the backplate (85).

(35) Remove the screws (84) that attach the motor mount (86) to the left-hand side plate (109). Remove the unidirectional gear (87) from the motor mount. Slide out the drive shaft assembly (88). Unsolder the wiring connections to the reroll motor (89) and remove the motor.

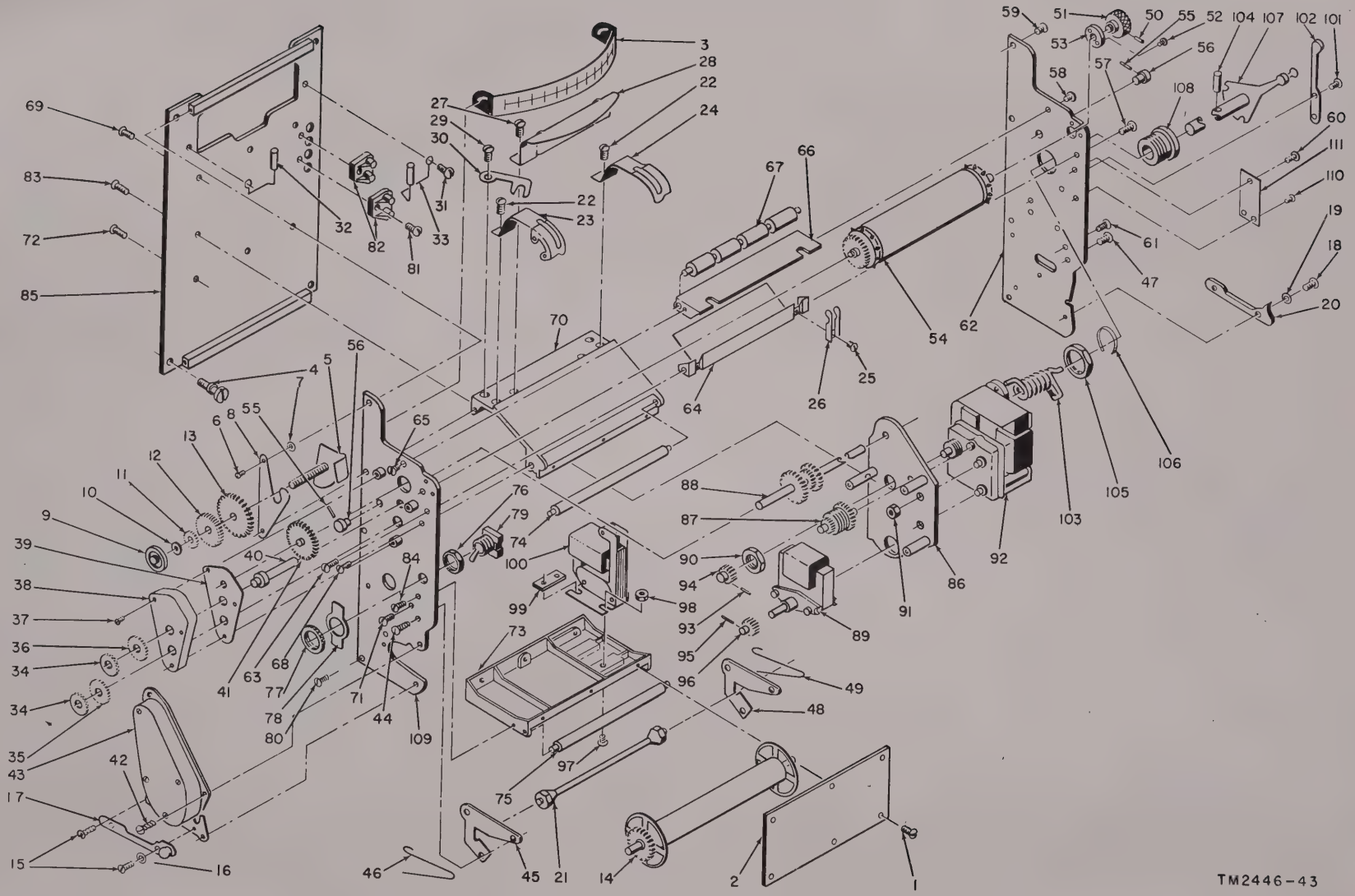


Figure 53. Wind speed synchronous chart drive, exploded view.

1 Screw (H550)
2 Instruction plate (A 570)
3 Scale (E514)
4 Screw (E535)
5 Change gear clip (A 536)
6 Screw (H552)
7 Washer (H553)
8 Change gear bracket (A 545)
9 Knurled nut (E525)
10 Change gear (O 504)
11 Change gear (O 512)
12 Change gear (O 516)
13 Change gear (O 508)
14 Reroll roller (O 533)
15 Screw (H557)
16 Washer (H558)
17 Left-hand reroll latch (E553)
18 Screw (H560)
19 Washer (H561)
20 Right-hand reroll latch (E551)
21 Chart supply arbor (A 522)
22 Screw (H562)
23 Left-hand chart guide (A 575)
24 Right-hand chart guide (A 570)
25 Screw (H551)
26 Guide fork (A 559)
27 Screw (H554)
28 Top drive roller plate (A 579)
29 Screw (H555)
30 Adjusting bracket (A 550)
31 Screw (H556)
32 Left-hand pen bumper (H564)
33 Right-hand pen bumper (H565)
34 Knurled nut (E526)
35 Change gear (O 523)
36 Change gear (O 524)
37 Screw (H559)
38 Drive gear cover (A 512)
39 Drive gear plate (A 582)
40 Pinion gear (O 584)
41 Idler gear (O 583)
42 Screw (H563)
43 Reroll gear train assembly (O 581)
44 Screw (H566)
45 Left-hand supply arbor bracket (A 537)
46 Spring (O 538)
47 Screw (H569)
48 Right-hand supply arbor bracket (A 541)
49 Spring (O 539)
50 Setscrew (H562)
51 Set knob (A 533)
52 Screw (H563)
53 Bushing (O 454)
54 Drive roller (E603)
55 Pin (E457)
56 Coupler knob (O 558)
57 Screw (H567)
58 Screw (H569)
59 Screw (H571)
60 Screw (H572)
61 Screw (H574)
62 Right-hand side plate (A 591)
63 Screw (H576)
64 Chart guide plate (A 593)
65 Screw (H577)
66 Chart roller plate (A 518)
67 Chart roller (O 529)
68 Screw (H567)
69 Screw (H568)
70 Top mounting plate (A 589)
71 Screw (H560)
72 Screw (H561)
73 Lower mounting plate (A 590)
74 Roller (O 546)
75 Roller (O 547)
76 Locknut (H564)
77 Knurled nut (H565)
78 Switch plate (H566)
79 Switch (S401)
80 Screw (H568)
81 Screw (H570)
82 Terminal block (E463)
83 Screw (H573)
84 Screw (H575)
85 Backplate (A 592)
86 Motor mount (A 571)
87 Unidirectional gear (O 572)
88 Drive shaft assembly (O 582)
89 Reroll motor (B401)
90 Locknut (H578)
91 Nut (H580)
92 Drive motor (B402)
93 Pin (H581)
94 Reroll motor drive gear (O 585)
95 Pin (H584)
96 Reroll motor drive gear (O 622)
97 Screw (H586)
98 Nut (H587)
99 Retaining plate (A 595)
100 Relay (K402)
101 Screw (H579)
102 Lever locking arm (A 569)
103 Spring (O 616)
104 Pin (H582)
105 Nut (H583)
106 Lock ring (H585)
107 Lever assembly (A 568)
108 Bushing (O 615)
109 Left-hand side plate (A 594)
110 Screw (H588)
111 Nameplate (N502)

Figure 53—Continued.

(36) Remove the motor drive gear (94) by driving out the pin (93). Remove the locknut (90) and the nuts (91) and separate the drive motor (92) from the motor mount (86).

(37) Remove the reroll motor drive gear (96) by driving out the pin (95).

(38) Remove the relay (100) by removing the screws (97), the nut (98), and the retaining plate (99).

(39) Remove the lever locking arm (102) by removing the screws (101).

(40) Slide the spring (103) off the lever assembly (107). Drive out the pin (104). Unscrew the nut (105) and slide the lever assembly (107) out of the right-hand side plate (62). Remove the lock ring (106) and slide the bushing (108) off the lever assembly shaft.

(41) Remove the nameplate (111) by removing the screw (110).

b. Wind Direction Synchronous Chart Drive (fig. 54).

(1) Remove the screws (1) and remove the instruction plate (2).

(2) Remove the scale (3) by lightly springing the ends toward each other and lifting the scale out of the chart drive.

(3) Remove the corner mounting screws (4).

(4) Remove the chart drive change gear clip (5) by lifting it up and out of the change gear bracket (8).

(5) Remove the change gear bracket (8) from the left-hand side plate (85) by removing the screws (6) and the washers (7).

(6) Remove the change gears (10, 11, 12, and 13) by removing the knurled nut (9) from the shaft of the change gear clip (5).

(7) Press down on the left- and right-hand reroll latches (17 and 20) and remove the reroll roller (14) by pulling it up and out of the chassis slots.

(8) Remove the left-hand reroll latch (17) from the reroll gear train assembly (44) by removing the screws (15) and the washer (16). Remove the right-hand reroll latch (20) by removing the screws (18) and the washer (19).

(9) Remove the chart supply arbor (21) by lifting it up and pulling it forward out of the chart drive.

(10) Remove the left- and right-hand chart guides (23 and 24) by removing the screws (22) that attach each chart guide.

(11) Remove the guide forks (26) by removing the screw (25) that attaches each fork.

(12) Remove the top drive roller plate (28) by removing the screws (27).

(13) Remove the adjusting brackets (30) by removing the screw (29) that attaches each bracket.

(14) Remove the left- and right-hand pen bumpers (32 and 33) by removing the screw (31) that attaches each bumper.

(15) Remove the knurled nuts (34) and remove the change gears (35 and 36).

(16) Remove the drive gear cover (38) by removing the screws (37).

(17) Remove the drive gear plate (39), pinion gear (40), and the idler gear (41). Pull out the gear train drive shaft assembly (42).

(18) Remove the screws (43) that retain the reroll gear train assembly (44). Lift the reroll gear train assembly carefully away from the chart drive. Disassemble the reroll gear train assembly as described in paragraph 74.

(19) Remove the left-hand supply arbor bracket (46) by removing the screws (45). Remove the spring (47) from the left-hand supply arbor bracket.

(20) Remove the right-hand supply arbor bracket (49) by removing the screws (48). Remove the spring (50) from the right-hand supply arbor bracket.

(21) Loosen the setscrew (51) and remove the set knob (52).

(22) Remove the screws (53) and slide the bushing (54) off the drive roller shaft. Lift up the right-hand end of the drive roller (55) and remove the drive roller.

(23) Drive the pin (56) out of each coupler knob (57) from each end of the drive shaft assembly (87).

(24) Remove the screw (58) that attaches the chart guide plate (65) to the right-hand side plate (63).

(25) Remove the screw (59) that attaches the chart roller guide plate (67) to the right-hand side plate (63) .

(26) Remove the screws (60) that attach the right-hand side plate to the upper and lower bar of the backplate (90). Remove the screws (61) that attach the top mounting plate (71) to the right-hand side plate (63). Remove the screws (62) that attach the lower mounting plate (75) to the right-hand side plate (63) and lift off the side plate.

(27) Remove the screw (64) and remove the chart guide plate (65). Remove the screw (66) and remove the chart roller plate (67). Push the chart roller (68) to one side and remove from the chart roller plate (67).

(28) Remove the screw (69) from the left-hand side plate (85) and screws (70) from the backplate (90). Lift off the top mounting plate (71). Slide the roller (72) to one end and remove from the top mounting plate (71).

(29) Remove the screw (73) from the left-hand side plate (85) and the screws (74) from the backplate (90). Lift off the lower mounting plate (75). Slide the roller (76) to one side and remove it from the lower mounting plate (75).

(30) Unsolder the wiring connections to the terminal block (89).

(31) Loosen the locknut (77). Remove the knurled nut (78), the switch plate (79), and the switch (80). Unsolder the switch wiring connections.

(32) Remove the screw (81) from the left-hand side plate (85). Remove the screw (82) and separate the backplate (90) from the motor mount (84).

(33) Remove the screws (73) and remove the motor mount (84) from the left-hand side plate (85). This releases the reroll motor (86) and the drive shaft assembly (87).
(34) Remove the terminal block (89) from the backplate (90) by removing the screw (88).
(35) Drive out the pin (91) from the motor gear (92) and slide the gear off the motor shaft.
(36) Remove the nameplate (94) by removing the screw (93).

73. Disassembly of Spring Chart Drives

Do not completely disassemble the spring chart drives unless absolutely necessary. Most troubles in the chart drives will be caused by careless handling. Be careful when handling the gears and shafts so that they will not be bent or knocked out of alinement.

a. Wind Speed Spring Chart Drive (fig. 55).

(1) Remove the crank (1) from the right-hand side plate (73) by pulling it out of the clip (71).
(2) Remove the screws (2) and remove the instruction plate (3).
(3) Remove the screws (4) and pull the spring motor (5) straight out of the right-hand side plate (73).
(4) Remove the switch lever (8) by removing the screw (6) and washer (7).
(5) Remove the screws (9) and lift the clock assembly (10) straight out of the chart drive.
(6) Remove the screw (11) and lift off the switch plate (12).
(7) Remove the scale (13) by lightly springing the ends toward each other and lifting the scale out of the chart drive.
(8) Remove the corner chart mounting screws (14).
(9) Remove the chart drive change gear clip (15) by lifting it up and out of the change gear bracket (18).
(10) Remove the change gear bracket (18) from the left-hand side plate (91) by removing the screws (16) and washers (17).
(11) Remove the change gears (20, 21, 22, and 23) by removing the knurled nut (19) from the shaft of the change gear clip (15).
(12) Press down on the left- and right-hand reroll latches (27 and 30) and remove the reroll roller (24) by pulling it up and out of the chassis slots.
(13) Remove the left-hand reroll latch (27) from the reroll gear train assembly (53) by removing the screws (25) and the washer (26). Remove the right-hand reroll latch (30) by removing the screws (28) and the washer (29).
(14) Remove the chart supply arbor (31) by lifting it up and pulling it forward out of the chart drive.
(15) Remove the left- and right-hand chart guides (33 and 34) by removing the screws (32) that attach each chart guide.
(16) Remove the guide forks (36) by removing the screws (35).
(17) Remove the top drive roller plate (38) by removing the screws (37).
(18) Remove the adjusting brackets (40) by removing the screws (39).
(19) Remove the left- and right-hand pen bumpers (42 and 43) by removing the screws (41).
(20) Remove the two knurled nuts (44) and remove the change gears (45 and 46).
(21) Remove the drive gear cover (48) by removing the screws (47).
(22) Pull off the drive gear plate (49), pinion gear (50) and the idler gear (51).
(23) Remove the screws (52) that retain the reroll gear train assembly (53). Lift the reroll gear train assembly carefully away from the chart drive. Disassemble the reroll gear train assembly (par. 75).
(24) Remove the left-hand supply arbor bracket (55) by removing the screws (54). Remove the spring (56) from bracket.
(25) Remove the right-hand supply arbor bracket (58) by removing the screws (57). Remove the spring (59) from bracket.
(26) Loosen the setscrew (60) and remove the set knob (61).
(27) Remove the screws (62) and slide the bushing (63) from the drive roller shaft. Lift up the right-hand drive roller (64) and remove the drive roller.
(28) Drive the pin (65) out of the coupler knobs (66) from each end of the drive shaft assembly (92).
(29) Remove the screw (67) that attaches the chart guide plate (75) to the right-hand side plate (73).

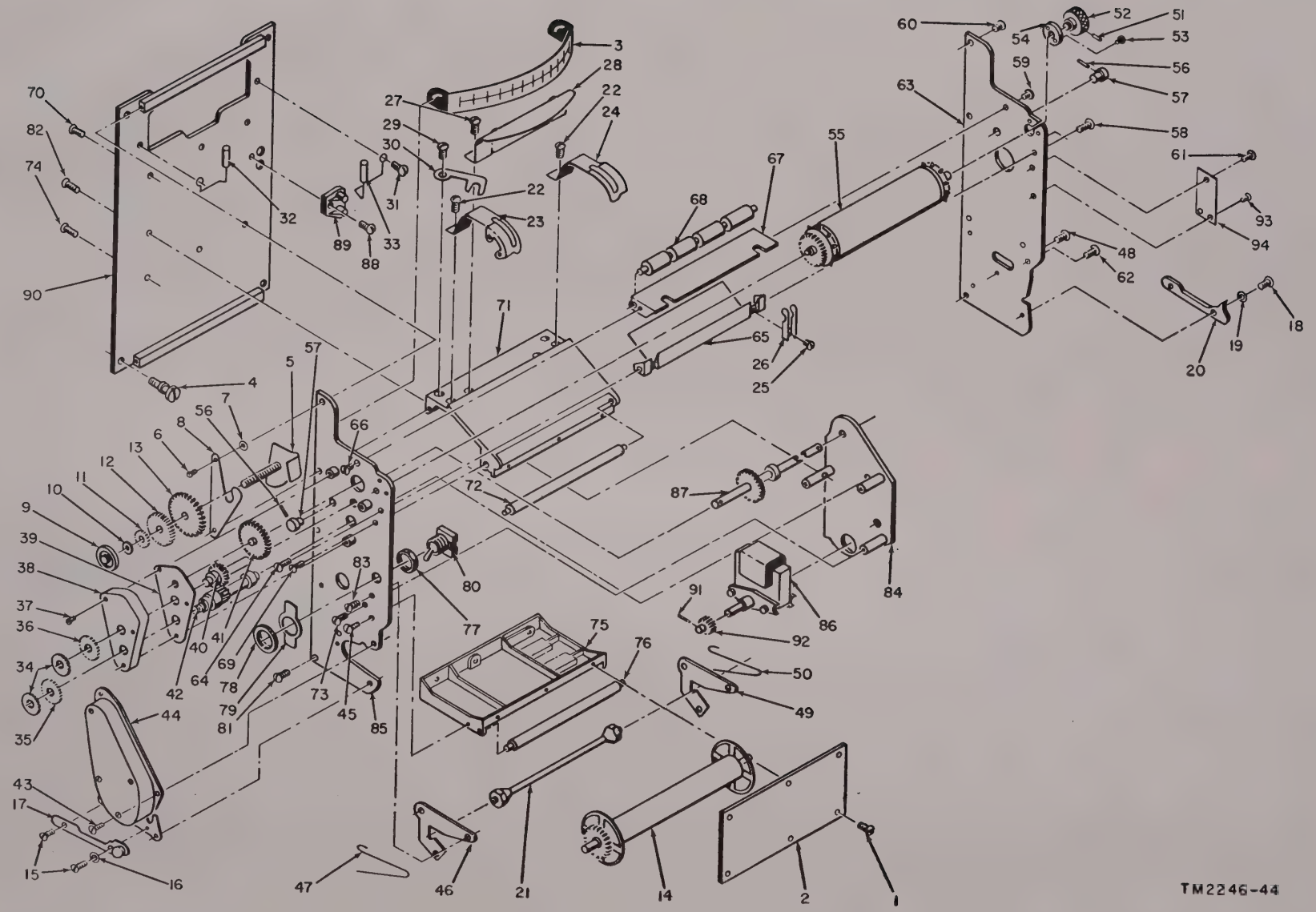


Figure 54. Wind direction synchronous chart drive, exploded view.

1 Screw (H401)
2 Instruction plate (O 571)
3 Scale (E515)
4 Screw (H531)
5 Change gear clip (A 525)
6 Screw (H404)
7 Washer (H406)
8 Change gear bracket (A 544)
9 Knurled nut (E521)
10 Change gear (O 503)
11 Change gear (O 511)
12 Change gear (O 515)
13 Change gear (O 507)
14 Reroll roller (O 532)
15 Screw (H411)
16 Washer (H412)
17 Left-hand reroll latch (E552)
18 Screw (H414)
19 Washer (H415)
20 Right-hand reroll latch (E549)
21 Chart supply arbor (A 521)
22 Screw (H402)
23 Left-hand chart guide (A 514)
24 Right-hand chart guide (A 515)
25 Screw (H403)
26 Guide fork (A 557)
27 Screw (H405)
28 Top drive roller plate (A 516)
29 Screw (H407)
30 Adjusting bracket (A 548)
31 Screw (H408)
32 Left-hand pen bumper (H409)
33 Right-hand pen bumper (H410)
34 Knurled nut (E519)
35 Change gear (O 519)
36 Change gear (O 520)
37 Screw (H413)
38 Drive gear cover (A 510)
39 Drive gear plate (A 583)
40 Pinion gear (O 572)
41 Idler gear (O 573)
42 Gear train drive shaft assembly (O 565)
43 Screw (H416)
44 Reroll gear train assembly (O 566)
45 Screw (H418)
46 Left-hand supply arbor bracket (A 536)
47 Spring (O 536)
48 Screw (H421)
49 Right-hand supply arbor bracket (A 540)
50 Spring (O 537)
51 Setscrew (H424)
52 Set knob (A 532)
53 Screw (H425)
54 Bushing (O 453)
55 Drive roller (O 527)
56 Pin (E455)
57 Coupler knob (O 556)
58 Screw (H429)
59 Screw (H431)
60 Screw (H433)
61 Screw (H435)
62 Screw (H436)
63 Right-hand side plate (A 404)
64 Screw (H437)
65 Chart guide plate (A 405)
66 Screw (H417)
67 Chart roller guide plate (A 517)
68 Chart roller (O 528)
69 Screw (H419)
70 Screw (H420)
71 Top mounting plate (A 401)
72 Roller (O 544)
73 Screw (H422)
74 Screw (H423)
75 Lower mounting plate (A 402)
76 Roller (O 545)
77 Locknut (H426)
78 Knurled nut (H427)
79 Switch plate (H428)
80 Switch (S569)
81 Screw (H430)
82 Screw (H432)
83 Screw (H434)
84 Motor mount (A 566)
85 Left-hand side plate (A 403)
86 Reroll motor (B501)
87 Drive shaft assembly (O 568)
88 Screw (H438)
89 Terminal block (E566)
90 Backplate (A 406)
91 Pin (H440)
92 Reroll motor drive gear (O 457)
93 Screw (H439)
94 Nameplate (N401)

Figure 54—Continued.

(30) Remove the screw (68) that attaches the chart roller plate (77) to the right-hand side plate (73).

(31) Remove the screws (69) that attach the right-hand side plate to the upper and lower bars of the backplate (89). Remove the screws (70) that attach the top mounting plate (81) and the clip (71) to the right-hand side plate (73). Remove the screws (72) that attach the lower mounting plate (85) to the right-hand side plate (73), and lift off the side plate.

(32) Remove the screw (74) from the left-hand side plate (91) and remove the chart guide plate (75). Remove the screw (76) from the left-hand side plate (91) and remove the chart roller plate (77). Push the chart roller (78) to one side and remove from the chart roller plate (77).

(33) Remove the screw (79) from the left-hand side plate (91) and the screws (80) from the backplate (89). Lift off the top mounting plate (81). Slide the roller (82) to one end and remove from the top mounting plate (81).

(34) Remove the screw (83) from the left-hand side plate (91) and the screws (84) from the backplate (89). Slide the roller (86) to one end and remove the lower mounting plate (85).

(35) Remove the screw (87) from the left-hand side plate (91) and the screw (88) from the backplate (89). Remove the backplate (89).

(36) Remove the nut (96) and slide out the reroll drive gear assembly (97) from the motor mount (98).

(37) Remove the screws (90) and remove the motor mount (98) from the left-hand side plate (91).

(38) Slide the drive shaft assembly (92) out of the motor mount (98). Slide the drive gear assembly (95) out of the motor mount (98).

(39) Remove the nut (94) and slide out the gear clutch (93).

b. Wind Direction Spring Chart Drive (fig. 56).

(1) Remove the crank (1) from the clip (64) on the right-hand side plate (66). Remove

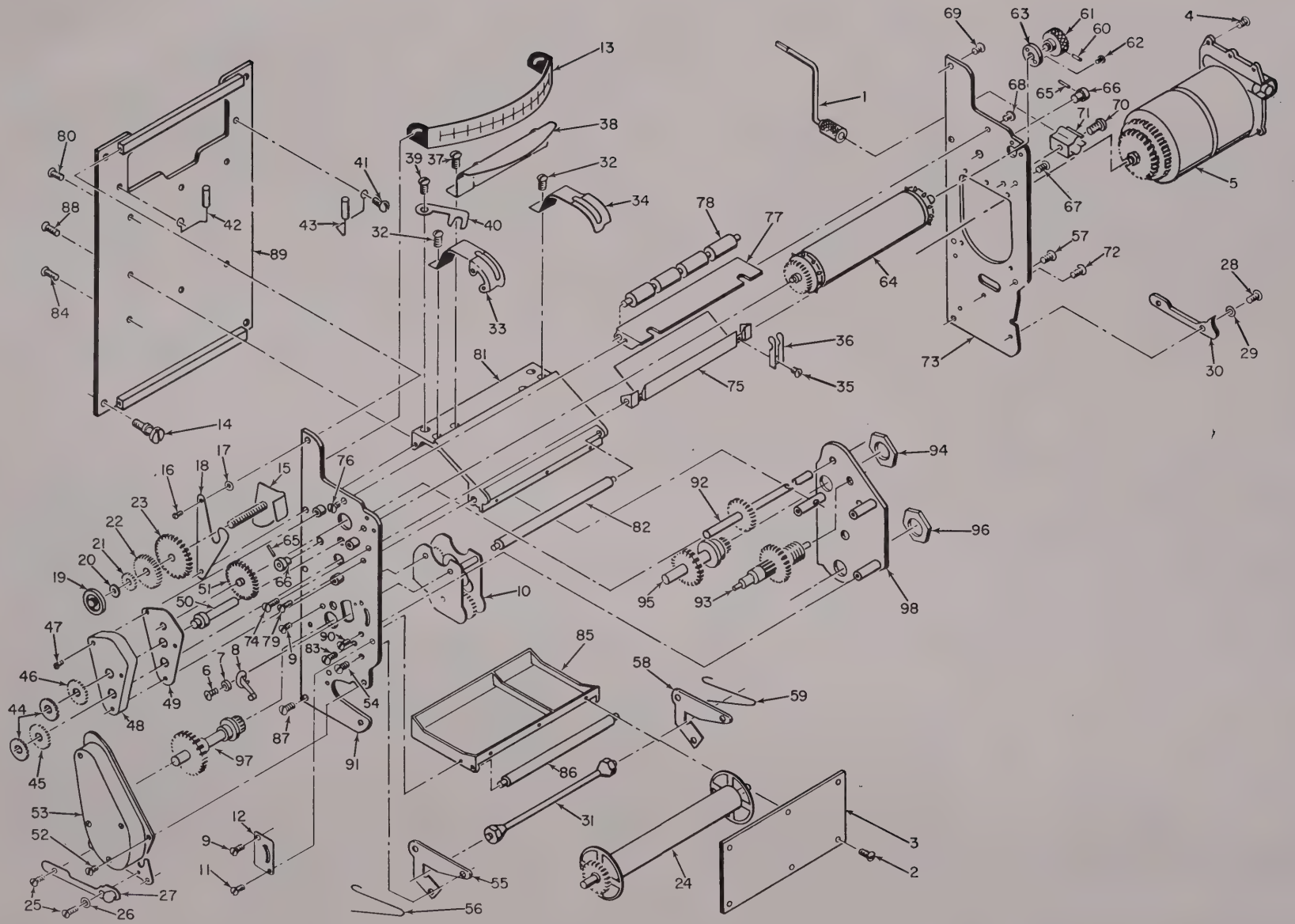


Figure 55. Wind speed spring chart drive, exploded view.

1 Crank (E568)
2 Screw (H441)
3 Instruction plate (A 572)
4 Screw (H446)
5 Spring motor (B505)
6 Screw (H448)
7 Washer (H444)
8 Switch lever (O 590)
9 Screw (H449)
10 Clock assembly (O 587)
11 Screw (H451)
12 Switch plate (H452)
13 Scale (E515)
14 Corner chart mounting screw (E543)
15 Change gear clip (A 528)
16 Screw (H455)
17 Washer (H456)
18 Change gear bracket (A 547)
19 Knurled nut (E528)
20 Change gear (O 506)
21 Change gear (O 514)
22 Change gear (O 518)
23 Change gear (O 510)
24 Reroll roller (O 535)
25 Screw (H445)
26 Washer (H447)
27 Left-hand reroll latch (E555)
28 Screw (H442)
29 Washer (H443)
30 Right-hand reroll latch (E551)
31 Chart supply arbor (A 524)
32 Screw (H450)
33 Left-hand chart guide (A 573)
34 Right-hand chart guide (A 578)
35 Screw (H453)
36 Guide fork (A 563)
37 Screw (H454)
38 Top drive roller plate (A 581)
39 Screw (H457)
40 Adjusting bracket (A 553)
41 Screw (H458)
42 Left-hand pen bumper (H459)
43 Right-hand pen bumper (H460)
44 Knurled nut (E530)
45 Change gear (O 525)
46 Change gear (O 526)
47 Screw (H461)
48 Drive gear cover (A 512)
49 Drive gear plate (A 584)
50 Pinion gear (O 592)
51 Idler gear (O 591)
52 Screw (H467)
53 Reroll gear train assembly (O 586)
54 Screw (H469)
55 Left-hand supply arbor bracket (A 539)
56 Spring (O 542)
57 Screw (H471)
58 Right-hand supply arbor bracket (A 543)
59 Spring (O 543)
60 Setscrew (H474)
61 Set knob (A 535)
62 Screw (H476)
63 Bushing (O 456)
64 Right-hand drive roller (O 605)
65 Pin (E461)
66 Coupler knob (O 562)
67 Screw (H462)
68 Screw (H463)
69 Screw (H464)
70 Screw (H465)
71 Clip (E580)
72 Screw (H466)
73 Right-hand side plate (A 407)
74 Screw (H468)
75 Chart guide plate (A 408)
76 Screw (H470)
77 Chart roller plate (A 520)
78 Chart roller (O 531)
79 Screw (H472)
80 Screw (H473)
81 Top mounting plate (A 409)
82 Roller (O 550)
83 Screw (H475)
84 Screw (H477)
85 Lower mounting plate (A 410)
86 Roller (O 551)
87 Screw (H478)
88 Screw (H479)
89 Backplate (A 411)
90 Screw (H481)
91 Left-hand side plate (A 412)
92 Drive shaft assembly (O 589)
93 Gear clutch
94 Nut (H480)
95 Drive gear assembly (O 594)
96 Nut (H482)
97 Reroll drive gear assembly (O 607)
98 Motor mount (A 413)

Figure 55—Continued.

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the screws (2) and remove the instruction plate (3).

(2) Remove the screws (4) and pull the reroll motor (5) out of the right-hand side plate (66).

(3) Remove the scale (6) by lightly springing the ends toward each other and lifting the scale out of the chart drive.

(4) Remove the corner chart mounting screws (7).

(5) Remove the chart drive change gear clip (8) by lifting it up and out of the change gear bracket (11).

(6) Remove the change gear bracket (11) from the left-hand side plate (89) by removing the screws (9) and the washers (10).

(7) Remove the change gears (13, 14, 15, and 16) by removing the knurled nut (12) from the shaft of the change gear clip (8).

(8) Press down on the left- and right-hand re-

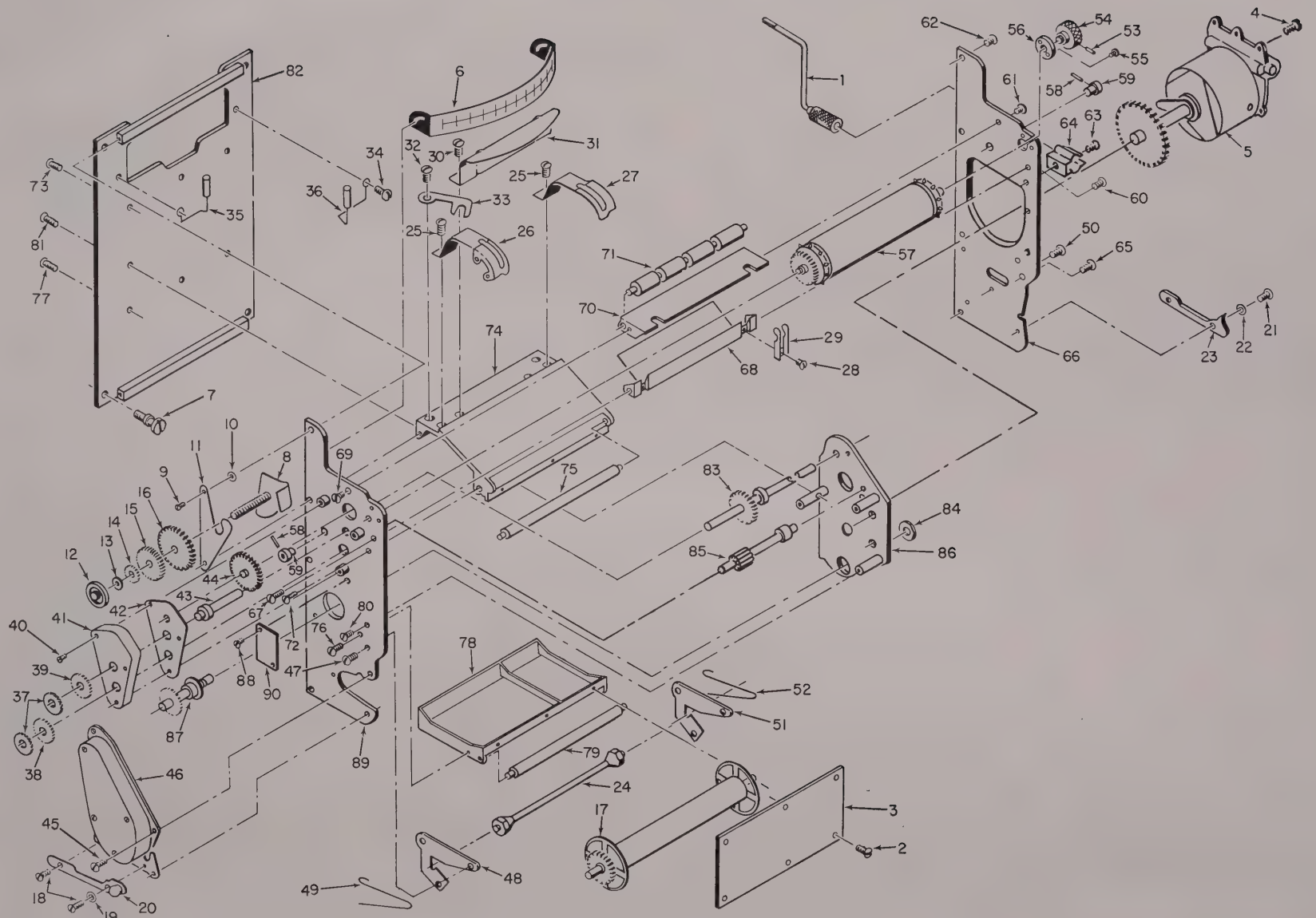


Figure 56. Wind direction spring chart drive, exploded view.

1 Crank (E580)
2 Screw (H601)
3 Instruction plate (O 614)
4 Screw (H603)
5 Reroll motor (B502)
6 Scale (E515)
7 Corner chart mounting screw (H539)
8 Change gear clip (A 527)
9 Screw (H606)
10 Washer (H608)
11 Change gear bracket (A 546)
12 Knurled nut (E525)
13 Change gear (O 505)
14 Change gear (O 514)
15 Change gear (O 517)
16 Change gear (O 509)
17 Reroll roller (O 534)
18 Screw (H613)
19 Washer (H614)
20 Left-hand reroll latch (E554)
21 Screw (H616)
22 Washer (H602)
23 Right-hand reroll latch (E550)
24 Chart supply arbor (A 523)
25 Screw (H604)
26 Left-hand chart guide (A 514)
27 Right-hand chart guide (A 577)
28 Screw (H605)
29 Guide fork (A 561)
30 Screw (H607)
31 Top drive roller plate (A 580)
32 Screw (H609)
33 Bracket (A 551)
34 Screw (H610)
35 Left-hand pen bumper (H611)
36 Right-hand pen bumper (H612)
37 Knurled nut (E527)
38 Change gear (O 524)
39 Change gear (O 523)
40 Screw (H615)
41 Drive gear cover (A 512)
42 Drive gear plate (A 556)
43 Pinion gear (O 578)
44 Drive gear (O 577)
45 Screw (H617)
46 Reroll gear train assembly (O 575)
47 Screw (H620)
48 Left-hand supply arbor bracket (A 538)
49 Spring (O 640)
50 Screw (H622)
51 Right-hand supply arbor bracket (A 542)
52 Spring (O 541)
53 Setscrew (H624)
54 Set knob (A 534)
55 Screw (H627)
56 Bushing (O 455)
57 Right-hand drive roller (O 604)
58 Pin (E459)
59 Coupler knob (O 560)
60 Screw (H630)
61 Screw (H631)
62 Screw (H633)
63 Screw (H634)
64 Clip (E570)
65 Screw (H636)
66 Right-hand side plate (A 604)
67 Screw (H618)
68 Chart guide plate (A 605)
69 Screw (H619)
70 Chart roller plate (A 519)
71 Chart roller (O 530)
72 Screw (H621)
73 Screw (H623)
74 Top mounting plate (A 606)
75 Roller (O 548)
76 Screw (H625)
77 Screw (H626)
78 Lower mounting plate (A 607)
79 Roller (O 549)
80 Screw (H628)
81 Screw (H629)
82 Backplate (A 608)
83 Drive shaft assembly (O 576)
84 Nut (H632)
85 Driving gear assembly
86 Motor mount (A 567)
87 Reroll drive gear assembly
88 Screw (H635)
89 Left-hand side plate (A 609)
90 Nameplate (N601)

Figure 56—Continued.

roll latches (20 and 23) and remove the reroll roller (17) by pulling it up and out of the chassis slots.

(9) Remove the left-hand reroll latch (20) from the reroll gear train assembly (46) by removing the screws (18) and the washer (19). Remove the right-hand reroll latch (23) by removing the screws (21) and the washer (22).

(10) Remove the chart supply arbor (24) by lifting it up and puling it forward out of the chart drive.

(11) Remove the left- and right-hand chart guides (26 and 27) by removing the screws (25).

(12) Remove the guide forks (29) by removing the screws (28).

(13) Remove the top drive roller plate (31) by removing the screws (30).

(14) Remove the adjusting brackets (33) by removing the screws (32).

(15) Remove the left- and right-hand pen bumpers (35 and 36) by removing the screws (34).

(16) Remove the knurled nuts (37) and remove the change gears (38) and (39).

(17) Remove the drive gear cover (41) by removing the screws (40).

(18) Pull off the drive gear plate (42), the pinion gear (43), and the drive gear (44).

(19) Remove the screws (45) that retain the reroll gear train assembly (46). Lift the reroll gear train assembly carefully away from the chart drive. Disassemble the reroll gear train assembly as described in paragraph 75.

(20) Remove the left-hand supply arbor bracket (48) by removing the screws (47). Remove the spring (49) from the left-hand supply arbor bracket (48).

(21) Remove the right-hand supply arbor bracket (51) by removing the screws (50). Remove the spring (52) from the right-hand supply arbor bracket.

(22) Loosen the setscrew (53) and remove the set knob (54) .

(23) Remove the screws (55) and slide the bushing (56) from the drive roller shaft.

Lift up the right-hand drive roller (57) and remove the drive roller.

(24) Drive the pin (58) out of the coupler knobs (59) from each end of the drive shaft assembly (83).

(25) Remove the screw (60) that attaches the chart guide plate (68) to the right-hand side plate (66).

(26) Remove the screw (61) that attaches the chart roller plate (70) to the right-hand side plate (66).

(27) Remove the screws (62) that attach the right-hand side plate to the upper and lower bar of the backplate (82). Remove the screws (63) that attach the top mounting plate (74) and clip (64) to the right-hand side plate (66). Remove the screws (65) that attach the lower mounting plate (78) to the right-hand side plate (66), and lift off the side plate.

(28) Remove the screw (67) from the left-hand side plate (89) and remove the chart guide plate (68). Remove the screw (69) and remove the chart roller plate (70). Push the chart roller (71) to one side and remove from the chart roller plate (70).

(29) Remove the screws (72) from the left-hand side plate (89) and the screws (73) from the backplate (82). Lift off the top mounting plate (74). Slide the roller (75) to one end and remove it from the top mounting plate (74).

(30) Remove the screw (76) from the left-hand side plate (89) and the screws (77) from the backplate (82) and remove the lower mounting plate (78). Slide the roller (79) to one end and remove from the lower mounting plate (78).

(31) Remove the screws (80) and the screw (81) and remove the motor mount (86) from the left-hand side plate (89).

(32) Slide the driving gear assembly (85) out of the motor mount (86). Remove the nut (84) and pull out the reroll drive gear assembly (87).

(33) Slide the drive shaft assembly (83) out of the motor mount (86).

(34) Remove the screws (88) and remove the nameplate (90) from the left-hand side plate (89).

74. Disassembly of Synchronous Chart Drive Reroll Gear Train

(fig. 57)

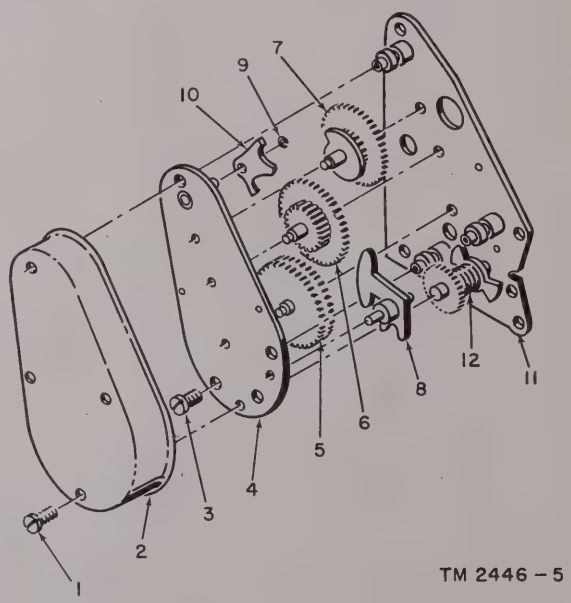
a. Remove the reroll gear train from the chart drive (par. 72).

b. Remove the gear train cover (2) by removing the screws (1) at the bottom and top of the gear train cover.

c. Remove the screws (3) and carefully lift off the gear plate (4). This releases the clutch assembly (5), the idler gear (6), the driving gear (7), and the weighted pawl (8).

d. Remove the lock ring (9) and lift the stop pawl (10) away from the gear plate (4).

e. The reroll clutch gear assembly (12) cannot be removed from the mounting plate assembly (11).



1 Screw (H701)
2 Gear train cover (H702)
3 Screw (H703)
4 Gear plate (H704)
5 Clutch assembly (O 599)
6 Idler gear (O 597)
7 Driving gear (O 595)
8 Weighted pawl (O 601)
9 Lock ring (H705)
10 Stop pawl (O 619)
11 Mounting plate assembly (O 620)
12 Reroll clutch gear assembly (p/o O 566)

Figure 57. Synchronous chart drive reroll gear train, exploded view.

75. Disassembly of Spring Chart Drive Reroll Gear Train

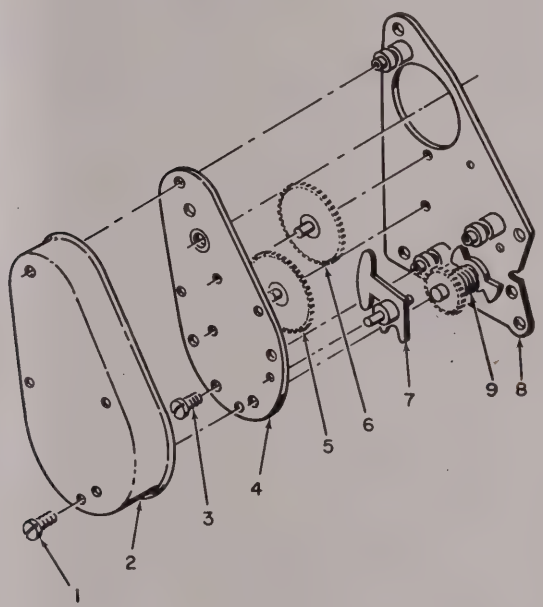
(fig. 58)

a. Remove the reroll gear train from the chart drive (par. 73).

b. Remove the gear train cover (2) by removing the screws (1) at the bottom and top of the gear train cover.

c. Remove the screws (3) and carefully lift off the gear plate (4). This releases the idler gear (5), the driving gear (6), and the weighted pawl (7).

d. The reroll clutch gear assembly (9) cannot be removed from the mounting plate assembly (8).



TM 2446-55

1 Screw (H706)
2 Gear train cover (H707)
3 Screw (H708)
4 Gear plate (H709)
5 Idler gear (O 611)
6 Driving gear (O 609)
7 Weighted pawl (O 599)
8 Mounting plate assembly (O 621)
9 Reroll clutch gear assembly (p/o O 575)

Figure 58. Spring chart drive reroll gear train, exploded view.

76. Disassembly of External Chart Drive

(fig. 59)

a. Remove the gear cover (2) by removing the screws (1). Unscrew the knurled nut (3) and remove the washer (4), the lockwasher (5), the washer (6), and the large drive gear (7). Unscrew the knurled nut (8) and remove the washer (9), the lockwasher (10), the washer (11), and the small drive gear (12).

b. Remove the corner screws (13) and the screws (14) and lift off the housing cover (15). Use a hand press to press the bushing (16) out of the housing cover (15). Remove the nuts (17), the washer (18), and the wiring terminals from the binding post assembly (52).

c. Remove the screws (19), the rubber washers (20), and the metal washers (21) that attach the motor (22) to the mounting plate (69). Remove the screws (23) that attach the cable clamps (24). Slide the motor (22) back out of the bottom side plate (55). Remove the coupler (25) from the motor shaft knob (27). Pull the motor wiring out of the grommet (56).

d. Drive out the pin (26) and remove the motor shaft knob (27). Loosen the setscrew (28) and remove the shaft collar (29) from the motor shaft.

e. Hold the locknut (30) with an open-end wrench on the inside of the top side plate (36) and unscrew the fitting (31). Loosen the locknut on the switch (34), unscrew the knurled nut (32), and remove the switch plate (33). Push the switch (34) out of the top side plate (36) and unsolder the wiring connections. Remove the screws (35) and remove the top side plate (36).

f. Lift out the bushing block (37), the drive shaft assembly (38), and the idler shaft assembly (39). Drive out the pin (40) and remove the shaft knob (41). Drive out the pin (42) and slide out the worm gear shaft (43). Remove the shaft stop (44) and the worm gear (45).

g. Remove the left-hand side plate (47) by removing the screws (46). Remove the right-hand side plate (49) by removing the screws (48). Remove the binding post assembly (52) and the voltage plate (53) from the right-hand side plate (49) by removing the nut (50) and the lockwasher (51).

h. Remove the bottom side plate (55) by removing the screws (54). Remove the grommet (56) from the bottom side plate (55).

i. Remove the gear housing backplate (65) from the mounting plate (69) by removing the screws (57), the washers (58), the nuts (59), the spacer nuts (60), the screws (61), the washers (62), the nuts (63), and the spacer nuts (64).

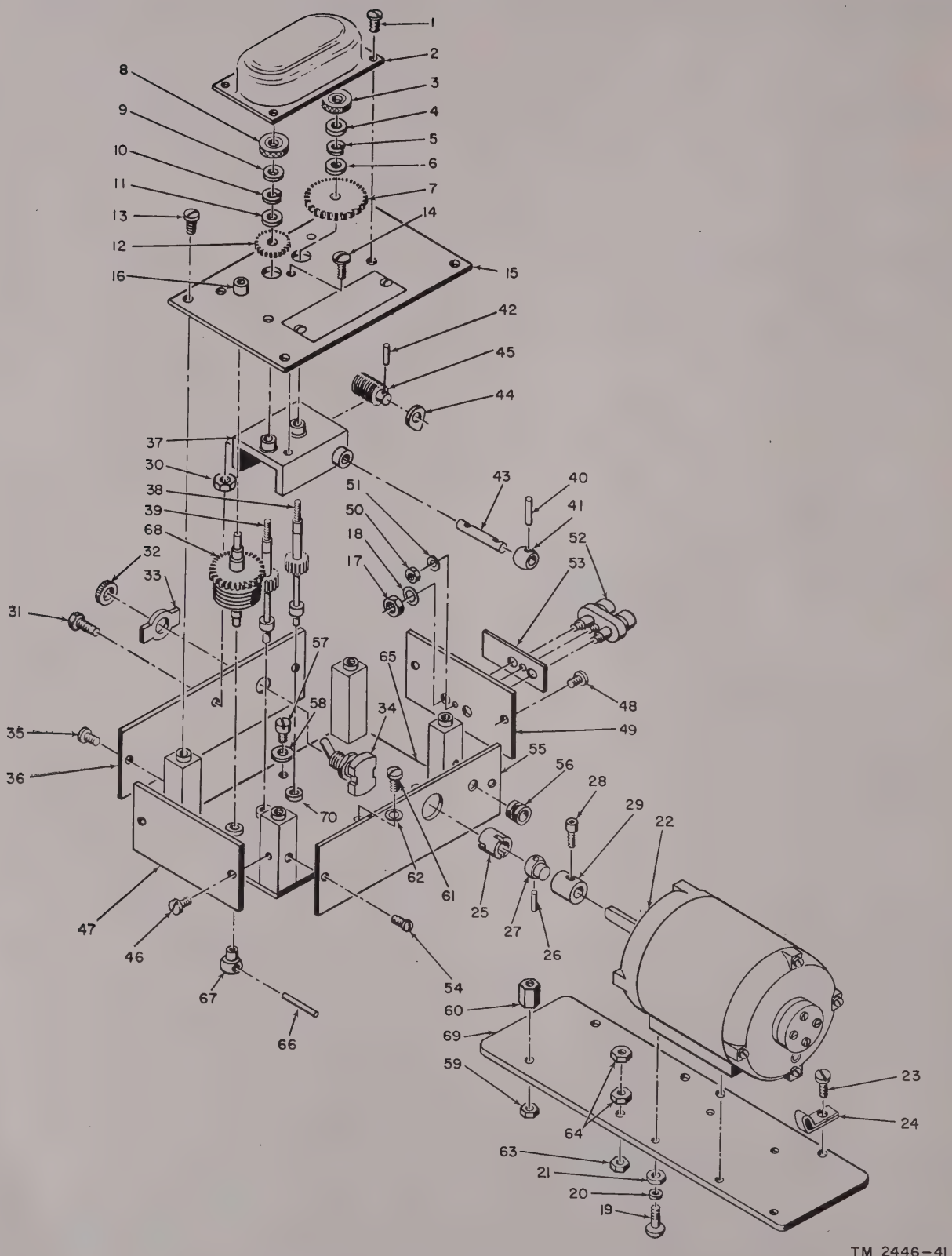


Figure 59. External chart drive motor, exploded view.

1 Screw (H801)
2 Gear cover (A 901)
3 Knurled nut (H802)
4 Washer (H803)
5 Lockwasher (H804)
6 Washer (H805)
7 Large drive gear (O 901)
8 Knurled nut (H806)
9 Washer (H807)
10 Lockwasher (H808)
11 Washer (H809)
12 Small drive gear (O 902)
13 Corner screw (H810)
14 Screw (H811)
15 Housing cover (A 902)
16 Bushing (O 903)
17 Nut (H812)
18 Washer (H812)
19 Screw (H814)
20 Washer, rubber (A 903)
21 Washer, metal (H815)
22 Motor (B1001)
23 Screw (H816)
24 Cable clamp (A 905)
25 Coupler (O 904)
26 Pin (H817)
27 Motor shaft knob (A 904)
28 Setscrew (H818)
29 Shaft collar (O 905)
30 Locknut (H810)
31 Fitting (O 906)
32 Knurled nut (H820)
33 Switch plate (H821)
34 Switch (S1001)
35 Screw (H822)
36 Top side plate (A 906)
37 Bushing block (A 907)
38 Drive shaft assembly (O 907)
39 Idler shaft assembly (O 908)
40 Pin (H823)
41 Shaft knob (A 908)
42 Pin (H824)
43 Worm gear shaft (O 909)
44 Shaft stop (O 910)
45 Worm gear (O 911)
46 Screw (H825)
47 Left-hand side plate (A 909)
48 Screw (H826)
49 Right-hand side plate (A 910)
50 Nut (H827)
51 Lockwasher (H828)
52 Binding post assembly (E1001)
53 Voltage plate (A 911)
54 Screw (H829)
55 Bottom side plate (A 912)
56 Grommet (A 913)
57 Screw (H830)
58 Washer (H831)
59 Nut (H832)
60 Spacer nut (H833)
61 Screw (H834)
62 Washer (H835)
63 Nut (H836)
64 Lower spacer nut (H837)
65 Gear housing backplate (A 914)
66 Pin (H838)
67 Clutch shaft knob (A 915)
68 Clutch assembly (O 912)
69 Mounting plate (A 916)
70 Bearing

Figure 59—Continued.

j. Drive out the pin (66) and remove the clutch shaft knob (67). Lift out the clutch assembly (68).

k. Press out the bearings (70) from the gear housing backplate (65) with a hand press.

l. Remove the ball bearings from the external chart drive motor.

m. Wash bearings with Cleaning Compound, and dry thoroughly.

77. Disassembly of Reducing Valve

(fig. 60)

Note. Do not disassemble the reducing valve unless absolutely necessary. Under no circumstances attempt to disassemble the valve beyond that described in *a* through *e* below.

a. Remove pressure gages M1 and M2 by unscrewing them from the valve housing. Remove the glass from the face of the gages by unscrewing the caps.

b. Remove handle H4 by unscrewing it counterclockwise.

c. Remove tank fitting H1 by unscrewing it at the base with a small pipe wrench.

d. Unscrew hose fitting H2.

e. Unscrew release valve H3.

78. Assembly of Equipment

Before assembling equipment, clean all components, straighten or repair parts that are dented or have other minor defects, and replace worn gears, bushings, bearings, shafts, gaskets, and threaded parts. If the wind speed or wind direction drive shafts or rotating heads need to be replaced, replace the entire drive shaft assembly. Instructions for the assembly of equipment is contained in paragraphs 79 through 90.

79. Assembly of Wind Speed Detector

(figs. 49 and 70)

a. Replace the slide fasteners (46, fig. 49). Place a slide fastener (46) over the end of the screw (43) followed by the washer (45) and the spring (44). Insert the screw (43) through the hole in the bottom housing (47), place the washer (42) over the end of the screw and attach with the cotter pin (41).

b. Refer to figure 70. Solder the wiring connections to the connector plug (39, fig. 49). Place the connector gasket (40) on the inside surface of the connector plug (39). Insert the ends of the wires through the hole in the bottom housing (47) and pull up through the top hole. Attach the connector plug (39) with the four screws (37) and the lockwashers (38).

c. Replace the tube retainer (35) and attach with the screws (32), the lockwashers (33), and the nuts (34). Solder the wiring connections to the phototube socket (36) and the bottom of the tube chassis (31).

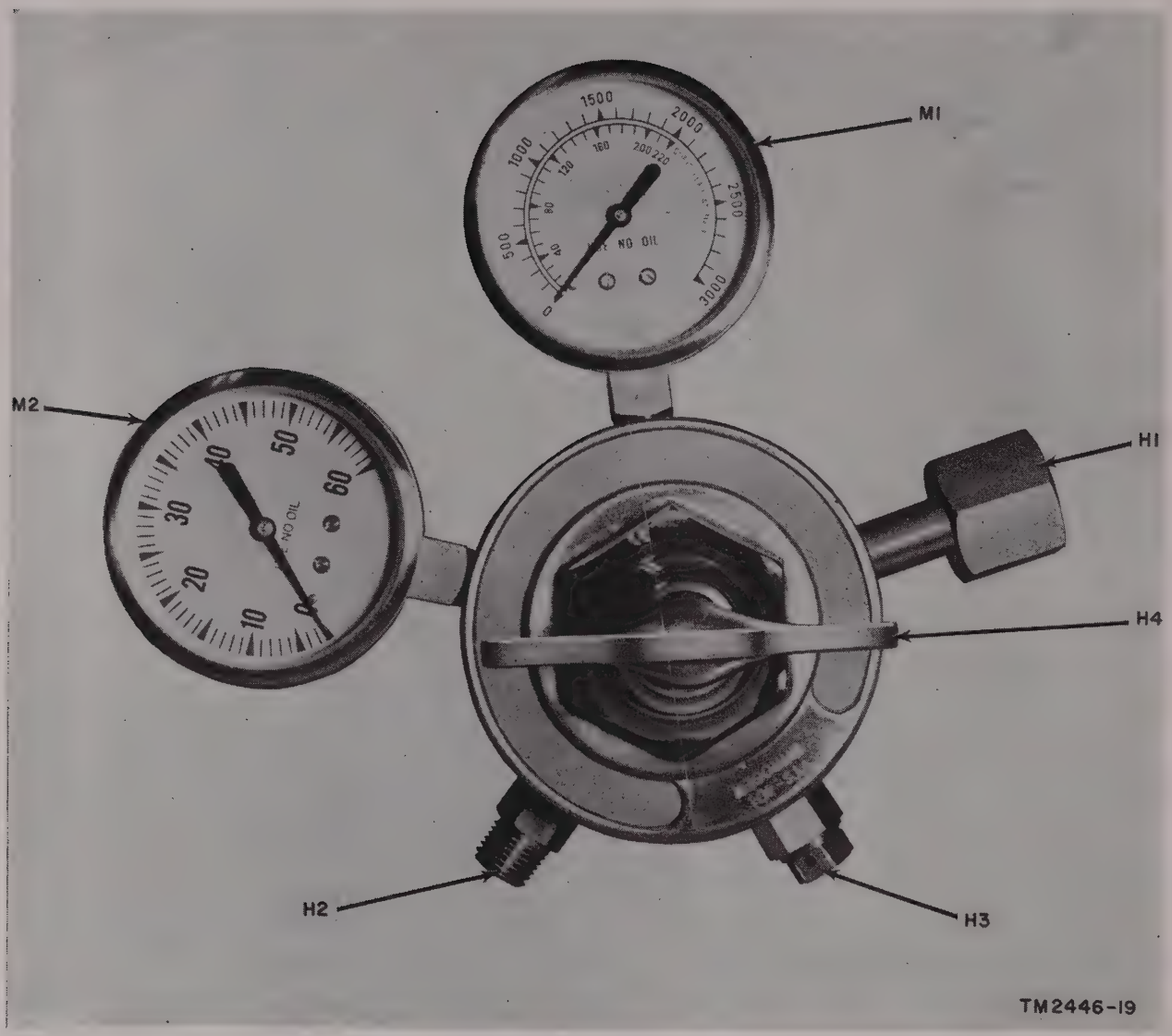


Figure 60. Reducing valve.

d. Replace the gasket (29) in the groove in the bottom of the top housing (30). Solder the wiring connections to the lamp holder mount (27). Insert the lamp holder mount through the hole in the bottom of the top housing (30). Turn the lamp holder mount until the slot in the side lines up with the screw hole in the bottom of the top housing (30). Attach the lamp holder mount (27) to the top housing (30) with the screw (25) and the lockwasher (26).

e. Place the gasket (24) over the threads of the drive shaft (23). Observe the caution in paragraph 69. Screw the drive shaft assembly (23) into the top of the top housing (30). Tighten the drive shaft assembly (23) with a pair of pliers with a piece of cloth wrapped around the teeth. Tighten the drive shaft just enough so that it cannot be loosened with the fingers.

f. Bend the wires from the lamp holder mount (27) so that they seat in the oval slot in the bottom of the top housing (30). Place the light chopper (22) over the end of the drive shaft assembly (23) with the shaft end down. Hold the light chopper (22) firmly against the end of the drive shaft (23) and tighten the allen head setscrews (21).

g. Position the light chopper plate (20) over the mounting holes in the bottom of the top housing (30) with the slot under the hole in the lamp holder mount (27) and over the phototube (10). Attach

the light chopper plate (20) with the screws (18) and the lockwashers (19).

h. Screw the upper supports (28) onto the studs in the bottom of the top housing (30). Insert the lower ends of the upper supports (28) through the mounting holes in the tube chassis (31). Screw on the lower supports (17). Attach the lower supports (17) to the bottom housing (47) with the screws (15) and the lockwashers (16).

i. Place the contact (7) in the top of the lamp retainer (6). Place the contact spring (5) in the top of the contact (7). Place the lamp retainer (6), spring end first, into the lamp holder housing (2). Press in on the lamp retainer (6) and aline one of the tapped holes in the side of the lamp retainer (6) with the hole in the side of the lamp holder housing (2). Replace the setscrew (4). Replace the exciter lamp (3). Place the gasket (8) over the threads of the lamp holder mount (27) and screw on the lamp holder housing (2). Tighten the lamp holder housing (2) with an open-end wrench just tight enough so that it cannot be unscrewed with the fingers.

j. Screw the locknut (12) onto the threaded end of the tubular shaft (13). Screw the tubular shaft (13) into the bottom housing (47) and tighten the locknut (12). Screw the plug (14) into the bottom of the tubular shaft (13).

k. Replace the phototube (10) and the tube (11) in their sockets.

l. Replace the gasket (48) in the groove in the inside of the housing cover (9). Slide the housing cover (9) with the gasket end down over the end of the tubular shaft and seat it against the gasket in the top housing (30). Slide the slide fasteners (46) out to retain the cover and tighten the screws (43).

m. Grip the rotating head of the drive shaft assembly (23) and insert the stem of the anemometer (1).

80. Assembly of Wind Direction Detector

(figs. 51 and 71)

a. Replace the gasket (37, fig. 51) in the top housing (36). Screw the mount spacers (33) onto the studs in the top housing (36).

b. Insert the variable resistor (32) through the center hole of the resistor mount (29) and attach with the lockwasher (31) and fingertight the nut (30). Position the resistor mount (29) on the mount spacers (33) and attach with the screws (27) and the lockwashers (28).

Note. Do not tighten the resistor nut (30) until the detector has been alined (par. 89).

c. Screw the supports (26) onto the studs in the bottom of the top housing (36).

d. Place the slide fasteners (25) over the end of the screws (21) followed by the washers (24) and the springs (23). Replace the screws (21) in the holes in the bottom housing (19). Place the washers (22) over the end of the screws (21) and secure the screws with the cotter pins (20).

e. Solder the wiring connections (fig. 71) to the connector plug (15, fig. 51), place the gasket (16) on the inside surface of the connector plug (15), and insert the wiring through the hole in the side of the bottom housing (19). Bring the wiring up through the center hole in the bottom housing (19). Attach the connector plug (15) to the bottom housing (19) with the screws (13) and the lockwashers (14).

f. Position the bottom housing (19) on the supports (26) and attach with the screws (17) and the lockwashers (18). Solder the wiring connections to the variable resistor (32).

g. Screw the locknut (10) onto the tubular shaft (11) and screw the tubular shaft into the bottom housing (19). Tighten the locknut (10). Screw the plug (12) into the bottom of the tubular shaft (11).

h. Place the gasket (35) over the end of the drive shaft assembly (34). Screw the drive shaft assembly (34) into the top housing (36). Fit the variable resistor (32) properly in the bottom of the drive shaft assembly (34). Tighten the drive shaft assembly with a pair of pliers with a cloth covering the teeth of the pliers. Tighten just enough so that the drive shaft assembly (34) cannot be turned with the fingers.

i. Replace the gasket (38) in the housing cover (9). Slide the housing cover over the lower end of the housing assembly and seat it firmly against the gasket (37) in the top housing (36). Slide the slide fasteners (25) outward to retain the housing cover (9) and tighten the screws (21).

j. Slide the collar (8) over the end of the tubular shaft (11). Place a metal washer (3), followed by the rubber washer (4) and metal washer (5) on the screw (2). Place the sighting bar (6) on the screw

(2) followed by the metal washer (7) and finger-tight the screw (2) into the collar (8).

k. Replace the wind vane (1) and aline the sighting bar as described in paragraph 91*d*.

81. Assembly of Synchronous Chart Drives

(figs. 53, 54, and 69)

Note. During reassembly, coat the bearing surfaces of all shafts with a very light coating of grease (GL). After the gear trains are assembled, apply a light touch of grease to the tips of gears intermittently throughout the gear train, then rotate to spread.

Caution: Over-lubrication will create excessive friction. *Do not lubricate the change gears.*

a. Wind Speed Synchronous Chart Drive (fig. 53).

(1) Place the bushing (108) on the shaft of the lever assembly (107). Press the collar of the bushing (108) tight against the handle of the lever assembly (107) and replace the lock ring (106). Insert the lever assembly (107) through the hole in the right-hand side plate (62) and screw the nut (105) onto the bushing (108). Drive the pin (104) through the hole in the shaft of the lever assembly (107). The pin (104) should protrude from each side of the shaft approximately three-sixteenths of an inch.

(2) Attach the lever locking arm (102) to the right-hand side plate (62); use the screws (101).

(3) Place the relay (100) on the lower mounting plate (73). Attach the relay (100); use the screw (97) and the nut (98) in the front mounting hole and the screws (97) and the retaining plate (99) in the rear mounting holes.

(4) Place the reroll motor drive gear (96) on the shaft of the reroll motor (89) and drive in the pin (95).

(5) Place the motor drive gear (94) on the shaft of the drive motor (92) and drive in the pin (93). Attach the drive motor (92) to the motor mount (86) by screwing the locknut (90) onto the drive motor shaft bushing and the nuts (91) onto the mounting studs.

(6) Insert the long end of the drive shaft assembly (88) into the hole in the left-hand side of the motor mount (86). Insert the unidirectional gear (87) into the bushing on the motor mount (86) with the large gear side against the bushing.

(7) Insert the shaft of the reroll motor (89) through the hole on the inside of the left-hand side plate (109). Position the motor mount (86) on the inside of the left-hand side plate (109) so that the ends of the unidirectional gear (87) and the drive shaft assembly (88) are inserted in the bushings in the left-hand side plate (109). Seat the notches in the bracket of the reroll motor (89) over the front mounting post on the motor mount (86). Attach the motor mount (86) to the left-hand side plate (109); use the screws (84).

(8) Attach the terminal blocks (82) to the backplate (85); use the screws (81).

(9) Slide the roller (74) into one of the holes in the front of the top mounting plate (70). Slide the roller as far as it will go in one hole, then slide it back into the hole in the opposite end of the top mounting plate (70).

(10) Slide the roller (75) into one of the holes in the front of the lower mounting plate (73). Slide the roller as far as it will go in one hole, then slide it back into the hole in the opposite end of the lower mounting plate (73).

(11) Attach the lower mounting plate (73) to the backplate (85); with the screws (72). Attach the top mounting plate (70) to the backplate (85); use the screws (69).

(12) Position the backplate (85) on the left-hand side plate (109). Replace the screw (83) through the backplate (85) into the back support of the motor mount (86). Attach the left-hand side plate (109) to the backplate (85); use the screw (80).

(13) Replace the screw (71) that attaches the left-hand side plate (109) to the lower mounting plate (73). Replace the screw (68) that attaches the left-hand side plate to the top mounting plate (70).

(14) Solder the wiring connections to the terminal blocks (82), the reroll motor (89), the drive motor (92), the relay (100), and

the switch (79). Screw the locknut (76) onto the bushing of the switch (79). Insert the bushing in the hole in the left-hand side plate (109). Place the switch plate (78) with the ON position at the top over the switch bushing. Turn the switch so that the ON position is up, and screw on the knurled nut (77).

(15) Place the chart roller (67) into the chart roller plate (66). Attach the chart roller plate (66) to the left-hand side plate (109); use the screw (65).

(16) Attach the chart guide plate (64) to the left-hand side plate (109); use the screw (63).

(17) Place the spring (103) over the end of the shaft of the lever assembly (107) with the large spring loop toward the lever. Place the right-hand side plate (62) into position. Turn the spring (103) so that the large spring loop will hold up the arm of the relay (100) with the switch lever in the UP position. Hook the spring (103) over the pin (104). Carefully insert the shaft of the lever assembly into the coupler of the drive motor (92).

(18) Attach the right-hand side plate (62) to the backplate (85); use the screws (59). Attach the right-hand side plate (62) to the chart roller plate (66); use the screw (58). Attach the right-hand side plate (62) to the chart guide plate (64); use the screw (57). Attach the right-hand side plate (62) to the lower mounting plate (73); use the screw (61).

(19) Place the coupler knob (56) on each end of the drive shaft assembly (88). Line up the pinholes and drive in the pin (55). The pins should protrude one-sixteenth of an inch on each side of the coupler knob (56).

(20) Replace the nameplate (111) on the right-hand side plate (62) with the screws (110 and 60). The screw (60) also attaches the right-hand side plate (62) to the top mounting plate (70).

(21) Place the spring (49) with the hook end over the back top bushing and the straight end resting on the lower bushing of the right-hand arbor supply bracket (48). Place the right-hand arbor supply bracket on the inside of the right-hand side plate (62) and attach with the screws (47).

(22) Place the spring (46) with the hook end over the back top bushing and the straight end resting on the lower bushing of the left-hand arbor supply bracket (45). Place the left-hand arbor supply bracket on the inside of the left-hand side plate (100) and attach with the screws (44).

(23) Replace the drive roller (54). Place the bushing (53) over the end of the drive roller shaft and attach with the screws (52). Place the set knob (51) on the end of the drive roller shaft and tighten the setscrew (50).

(24) Position the reroll gear train assembly (43) on the left-hand side plate (109). Be sure that the gears mesh properly with the reroll motor drive gear (96) and attach with the screws (42).

(25) Replace the right-hand reroll latch (20) and attach it to the right-hand side plate (62) with the screws (18) and washer (19). Place the washer (19) under the head of the outer screw (18).

(26) Replace the left-hand reroll latch (17) and attach it to the left-hand side plate (109) with the screws (15) and the washer (16). Place the washer (16) under the head of the outer screw (15).

(27) Replace the idler gear (41) and pinion gear (40) by inserting them through the holes in the left-hand side plate (109). Be sure that the gears are properly meshed, and replace the drive gear plate (39). Place the drive gear cover (38) over the drive gear plate (39) and attach with the screws (37).

(28) Replace the change gears (36 and 35) and screw on the knurled nuts (34).

(29) Place a guide fork (26) at each end of the chart guide plate (64) and attach each guide fork with a screw (25).

(30) Place the left- and right-hand chart guides (23 and 24) in place at each end of the drive roller (54) and attach each chart guide to the top mounting plate (70) with the screws (22).

(31) Replace the left- and right-hand pen bumpers (32 and 33) and attach the bumpers to the backplate (85) with the screw (31).

(32) Replace the adjusting brackets (30) on the top mounting plate (70) and attach the brackets with the screws (29).

(33) Place the top drive roller plate (28) on top of the top mounting plate (70) and attach with the screws (27). Before tightening the screws (27), slide in the adjusting brackets (30) so that the slotted end of the bracket engages the screws (27) under the top drive roller plate (28).

(34) Replace the chart supply arbor (21) and the reroll roller (14).

(35) Replace the scale (3) by springing in the ends and fitting it over the pins in the top of each side plate.

(36) Attach the change gear bracket (8) to the left-hand side plate (109); use the screws (6) and the washers (7).

(37) Place the change gears (10, 11, 12, and 13) on the shaft of the change gear clip (5) in the change gear bracket (8).

(38) Replace the screws (4) in the corners of the backplate (85).

(39) Replace the instruction plate (2) using the screws (1).

b. Wind Direction Synchronous Chart Drive (fig. 54).

(1) Slide one end of the roller (76) into one of the holes in the front of the lower mounting plate (75). Push the roller in as far as it will go, then slide it into the hole in the opposite end of the mounting plate.

(2) Attach the lower mounting plate (75) to the backplate (90); use the screws (74).

(3) Place the reroll motor drive gear (92) on the reroll motor (86) and drive in the pin (91). Place the reroll motor drive gear (92) on the reroll motor (86) through the hole in the left-hand side plate (85). Insert the long end of the drive shaft assembly (87) through the hole on the inside of the motor mount (84). Place the motor mount (84) against the inside of the left-hand side plate (85) with the drive shaft assembly (87) inserted in its bushing and the notches in the reroll motor (86) seated over the lower outside motor mount (84). Attach the motor mount (84) to the left-hand side plate (85); use the screws (73).

(4) Attach the terminal block (89) to the backplate (90); use the screw (88).

(5) Place the backplate (90) in position against the left-hand side plate (85). Replace the screw (81) that attaches the left-hand side plate (85) to the bottom bar on the backplate (90). Insert the screw (45) that attaches the left-hand side plate (85) to the lower mounting plate (75). Replace the screw (82) through the backplate (90) into the back support of the motor mount (84).

(6) Solder the wiring connections to the terminal block (89), the reroll motor (86), and the switch (80). Screw the locknut (77) onto the switch (80). Insert the switch through the hole on the inside of the left-hand side plate (85). Place the switch plate (79) with the ON position at the top over the switch bushing. Turn the switch so that the ON position is up and screw on the knurled nut (78).

(7) Replace the roller (72) in the top mounting plate (71). Replace the top mounting plate (71) and attach it to the backplate with screws (70) and to the left-hand side plate with the screw (69).

(8) Place the chart roller (68) into the chart roller guide plate (67). Attach the chart roller guide plate (67) to the left-hand side plate (85) with the screw (66).

(9) Attach the chart guide plate (65) to the left-hand side plate (85) with the screw (64).

(10) Replace the right-hand side plate (63). Attach the right-hand side plate (63) to the backplate (90) with the screws (60). Attach the right-hand side plate (63) to the chart roller guide plate (67) with the screw (59). Attach the right-hand side plate (63) to the chart guide plate (65) with the screw (58). Attach the right-hand side plate (63) to the lower mounting plate (75) with the screw (62).

(11) Place the coupler knobs (57) on each end of the drive shaft assembly (87). Line up

the pinholes and drive in the pin (56). The pins should protrude approximately one-sixteenth of an inch on each side of the coupler knob (57).

(12) Replace the nameplate (94) on the right-hand side plate (63) and screw in the screws (93) and the screw (61). The screw (61) also attaches the right-hand side plate (63) to the top mounting plate (71).

(13) Place the spring (50) with the hook end over the back top bushing and the straight end resting on the lower bushing of the right-hand supply arbor bracket (49). Place the right-hand supply arbor bracket (49) on the inside of the right-hand side plate (63) and attach with the screws (48).

(14) Place the spring (47) with the hook end over the back top bushing and the straight end resting on the lower bushing of the left-hand supply arbor bracket (46). Place the left-hand supply arbor bracket (46) on the inside of the left-hand side plate (85) and attach with the screws (83).

(15) Replace the drive roller (55). Place the bushing (54) over the end drive roller shaft and attach with the screws (53). Place the set knob (52) on the end of the drive roller shaft and tighten the setscrew (51).

(16) Position the reroll gear train assembly (44) on the left-hand side plate (85). Be sure that the gears mesh properly with the reroll motor drive gear (92) and attach with the screws (43).

(17) Replace the right-hand reroll latch (20) and attach it to the right-hand side plate (63) with the screws (18) and washer (19). Place the washer (19) under the head of the outer screw (18).

(18) Replace the left-hand reroll latch (17) and attach it to the left-hand side plate (85) with the screws (15) and the washer (16). Place the washer (16) under the head of the outer screw (15).

(19) Replace the gear train drive shaft assembly (42), idler gear (41), and pinion gear (40) by inserting them through the holes in the left-hand side plate (85). Be sure that the gears are properly meshed and replace the drive gear plate (39). Place the drive gear cover (38) over the drive gear plate (39) and attach with the screws (37).

(20) Replace the change gears (36 and 35) and screw on the knurled nuts (34).

(21) Place a guide fork (26) at each end of the chart guide plate (65) and attach each guide fork with the screws (25).

(22) Place the left- and right-hand chart guides (23 and 24) in place at each end of the drive roller (55) and attach the chart guides to the top mounting plate (71) with the screws (22).

(23) Replace the left- and right-hand pen bumpers (32 and 33) and attach each bumper to the backplate (90) with the screws (31).

(24) Replace the two adjusting brackets (30) on the top mounting plate (71) and attach the brackets with the screws (29).

(25) Place the top drive roller plate (28) on top of the top mounting plate (71) and attach with the screws (27). Before tightening the screws (27), slide the adjusting brackets (30) so that the slotted end of each bracket engages the screws (27) under the top drive roller plate (28).

(26) Replace the chart supply arbor (21) and the reroll roller (14).

(27) Replace the scale (3) by springing in the ends and fitting it over the pins in the top of the side plates.

(28) Attach the change gear bracket (8) to the left-hand side plate (85) with the screws (6) and the washer (7).

(29) Place the change gears (10, 11, 12, and 13) on the shaft of the change gear clip (5) and secure with the knurled nut (9). Slide the change gear clip (5) in the change gear bracket (8).

(30) Replace the screws (4) in the corners of the backplate (90).

(31) Replace the instruction plate (2) with the screws (1).

82. Assembly of Spring Chart Drives

a. Wind Speed Spring Chart Drive (fig. 55).

(1) Slide one end of the roller (86) into one of the holes in the front of the lower mounting

plate (85). Push the roller in as far as it will go, and slide it into the hole in the opposite end of the mounting plate.

(2) Attach the lower mounting plate (85) to the backplate (89) with the screws (84).

(3) Insert the small gear end of the reroll drive gear assembly (97) into the hole in the motor mount (98) and screw on the nut (96). Insert the clutch end of the gear clutch (93) into the hole in the motor mount (98) and screw on the nut (94). Insert the long end of the drive shaft assembly (92) through the hole in the motor mount (98). Insert the small gear end of the drive gear assembly (95) through the hole in the motor mount (98).

(4) Position the motor mount (98) on the inside of the left-hand side plate (91) and attach with the screws (90).

(5) Place the backplate (89) against the left-hand side plate (91) and replace the screws (87 and 88) through the backplate and the screw (83) through the left-hand side plate.

(6) Insert one end of the roller (82) in one of the holes in the front of the top mounting plate (81). Slide the other end of the roller into the opposite hole in the top mounting plate (81). Attach the top mounting plate (80) to the backplate (89) with the screws (80) and to the left-hand side plate (91) with the screw (79).

(7) Place the chart roller (78) in the chart roller plate (77). Attach the chart roller plate to the left-hand side plate (91) with the screw (76).

(8) Attach the chart drive plate (75) to the left-hand side plate (91) with the screw (74).

(9) Attach the lower mounting plate (85) to the right-hand side plate (73) with the screws (72).

(10) Attach the clip (71) to the right-hand side plate (73) with one screw (70). Replace the remaining screw (70) to attach the top mounting plate (81) to the right-hand side plate (73).

(11) Replace the screws (69) that attach the upper and lower bars of the backplate (89) to the right-hand side plate (73). Replace the screw (68) that attaches the chart roller plate (77) to the right-hand side plate (73). Replace the screw (67) that attaches the chart guide plate (75) to the right-hand side plate (73).

(12) Place a coupler knob (66) on each end of the drive shaft assembly (92). Line up the pinholes and drive in a pin (65). The pins should protrude approximately one-sixteenth of an inch on each side of the coupler knob.

(13) Replace the right-hand drive roller (64). Place the bushing (63) over the end of the drive roller and attach it to the right-hand side plate (73) with the screws (62). Place the set knob (61) on the drive roller shaft and tighten the setscrew (60).

(14) Place the spring (59) with the hook end over the back top bushing and the straight end resting on the lower bushing of the right-hand supply arbor bracket (58). Place the right-hand supply arbor bracket (58) on the inside of the right-hand plate (73) and attach with the screws (57).

(15) Place the spring (56) with the hook end over the back top bushing and the straight end resting on the lower bushing of the left-hand supply arbor bracket (55). Place the left-hand supply arbor bracket (55) on the inside of the left-hand side plate (91) and attach with the screws (54).

(16) Replace the reroll gear train assembly (53). Be sure that the gears are meshed with the reroll drive gear assembly (97) and attach with the screws (52).

(17) Replace the pinion gear (50) and the idler gear (51). Place the drive gear plate (49) over the mounting bushings on the left-hand side plate (91). Replace the drive gear cover (48) and attach with the screws (47).

(18) Place the change gears (45 and 46) on the pinion gear and idler gear shafts (50 and 51) and screw on the knurled nuts (44).

(19) Insert a screw (16) through each of the mounting holes in the change gear bracket (18). Place a washer (17) over the end of each screw and attach the change gear

bracket (18) to the left-hand side plate (91).

(20) Place the change gears (20, 21, 22, and 23) onto the shaft of the change gear clip (15) and screw on the knurled nut (19). Slide the change gear clip (15) in the change gear bracket (18).

(21) Attach the right-hand reroll latch (30) to the right-hand side plate (73) with the screws (28) and the washer (29). Place the washer (29) under the head of the front screw (28).

(22) Attach the left-hand reroll latch (27) to the reroll gear train assembly (53) with the screws (25) and the washer (26). Place the washer (26) under the head of the front screw (25).

(23) Place the left- and right-hand chart guides (33 and 34) into their positions at each end of the right-hand drive roller (64) and secure each chart guide with the screws (32).

(24) Place a guide fork (36) at each end of the chart drive plate (75) and secure with the screws (35).

(25) Place an adjusting bracket (40) on each end of the top mounting plate (81) and attach with the screws (39).

(26) Attach the right- and left-hand pen bumpers (42 and 43) to the backplate (89) with the screws (41).

(27) Place the top drive roller plate (38) on top of the top mounting plate (81) and replace the screws (37). Before tightening the screws, turn the adjusting brackets (40) so that the hooked end of each bracket engages the screws (37).

(28) Insert the spring motor (5) through the right-hand side plate (73) so that the motor shaft fits into the bushing in the center of the motor mount (98) and the spring motor gears engage the gears on the drive gear assembly (95). Attach the spring motor (5) with the screws (4).

(29) Replace the chart supply arbor (31) and the reroll roller (24).

(30) Replace the switch plate (12) and attach with the lower mounting screw (11).

(31) Gently place the clock assembly (10) with the balance wheel facing out between the motor mount (98) and the inside of the left-hand side plate (91). Hold the inside edge of the clock assembly (10) with a pair of long-nose pliers. Be sure that the clock assembly gears mesh with the gears in the gear clutch (93). Aline the mounting holes and replace the screws (9).

(32) Replace the switch lever (8) and attach with the screw (6) and washer (7).

(33) Replace the instruction plate (3) and attach with the screws (2).

(34) Replace the corner chart mounting screws (14) in the corner holes of the backplate (89).

(35) Place the crank (1) with the square end in the hole in the backplate and the handle end in the clip (71).

(36) Replace the scale (13) by springing in the ends and fitting it over the pins in the top of each side plate.

b. Wind Direction Spring Chart Drive (fig. 56).

(1) Slide one end of the roller (79) into one of the holes in the front of the lower mounting plate (78). Push the roller in as far as it will go, and slide it into the hole in the opposite end of the mounting plate.

(2) Attach the lower mounting plate (78) to the backplate (82) with the screws (77).

(3) Position the motor mount (86) on the inside of the left-hand side plate (89) and attach with the screws (80). Replace the screw (76). Insert the small gear end of the reroll drive gear assembly (87) into the hole in the motor mount (86) and screw on the nut (84). Insert the long end of the drive shaft assembly (83) through the hole in the motor mount (86).

(4) Slide one end of the roller (75) into one of the holes in the front of the top mounting plate (74). Push the roller in and slide it into the opposite hole in the top mounting plate (74).

(5) Attach the top mounting plate to the left-hand side plate (89) with the screw (72).

(6) Place the backplate (82) against the left-hand side plate (89) and replace the screws (73) and the screw (81) through the backplate (82).

(7) Place the chart roller (71) in the chart roller plate (70) and attach the chart roller plate (70) to the inside of the left-hand side plate (89) with the screw (69).

(8) Attach the chart guide plate (68) to the inside of the left-hand side plate (89) with the screw (67).

(9) Attach the right-hand side plate (66) to the backplate (82) with the screws (62). Attach the right-hand side plate (66) to the chart guide plate (68) with the screw (60). Attach the right-hand side plate (66) to the chart roller plate (70) with the screw (61). Attach the right-hand side plate (66) to the lower mounting plate with the screws (65).

(10) Place one screw (63) in the clip (64) and attach it through the right-hand side plate (66) to the top mounting plate (74). Replace the remaining screw (63) that attaches the top mounting plate (74) to the right-hand side plate (66).

(11) Place the coupler knobs (59) over each end of the drive shaft assembly (83). Aline the pinholes and drive the pins (58) through the coupler knobs. The pins should protrude approximately one-sixteenth of an inch on each side of the coupler knob.

(12) Replace the right-hand drive roller (57). Place the bushing (56) over the end of the drive roller shaft on the right-hand side plate (66) and replace the screws (55). Place the set knob (54) on the end of the drive roller shaft and tighten the setscrew (53).

(13) Place the guide forks (29) on each end of the chart guide plate (68) and attach each fork with the screws (28).

(14) Place the left-hand chart guide (26) on the left-hand end of the top mounting plate (74) and the right-hand chart guide (27) on the right-hand end of the mounting plate. Attach the chart guides with the screws (25).

(15) Place the brackets (33) on the top mounting plate (74) and attach the brackets with the screws (32). Place the top drive roller plate (31) on the top mounting plate (74) and attach with the screws (30). Before tightening the screws (30), slide the brackets (33) so that the slotted ends engage the screws (30).

(16) Attach the left- and right-hand pen bumpers (35 and 36) to the backplate (82) with the screws (34).

(17) Replace the reroll gear train assembly (46) on the left-hand side plate (89) and attach with the screws (45). Be sure the gears in the reroll gear train assembly (46) mesh with large gear on the reroll drive gear assembly (87).

(18) Replace the driving gear assembly (85). Replace the pinion gear (43) and the drive gear (44). Place the drive gear plate (42) over the gears (43 and 44) so that it seats on the bushings in the left-hand side plate (89). Place the drive gear cover (41) over the drive gear plate (42) and attach with the screws (40).

(19) Replace the change gears (38 and 39) and attach with the knurled nuts (37).

(20) Insert the screws (9) into each of the two mounting holes in the change gear bracket (11). Place the washers (10) over the threads of the screws (9) and attach the change gear bracket (11) to the left-hand side plate (89).

(21) Place the change gears (13, 14, 15, and 16) on the shaft of the change gear clip (8) and screw on the knurled nut (12). Place the change gear clip (8) in the change gear bracket (11).

(22) Attach the right-hand reroll latch (23) to the right-hand side plate (66) with the screws (21) and the washer (22). Place the washer (22) under the head of the outer screw (21).

(23) Attach the left-hand reroll latch (20) to the reroll gear train assembly (46) with the screws (18) and the washer (19). Place the washer (19) under the head of the outer screw (18).

(24) Place the spring (52) with hook end over the back top bushing and the straight end

resting on the lower bushing of the right-hand supply arbor bracket (51). Place the right-hand supply arbor bracket (51) on the inside of the right-hand side plate (66) and attach with the screws (50).

(25) Place the spring (49) with the hook end over the back top bushing and the straight end resting on the lower bushing of the right-hand supply arbor bracket (48). Place the left-hand supply arbor bracket (48) on the inside of the left-hand side plate (89) and attach with the screws (47).

(26) Insert the reroll motor (5) through the right-hand side plate (66) so that the motor shaft fits into the bushing in the center of the motor mount (86) and the reroll motor gears engage the gears in the driving gear assembly (85). Attach the reroll motor (5) with the screws (4).

(27) Replace the chart supply arbor (24) and the reroll roller (17).

(28) Replace the nameplate (90) and attach with the screws (88).

(29) Replace the instruction plate (3) and attach with the screws (2).

(30) Replace the corner chart mounting screws (7) into the corner holes in the backplate (82).

(31) Place the crank (1) with the square end in the hole in the backplate and the handle end in the clip (64).

(32) Replace the scale (6) by springing in the ends and fitting it over the pins in the top of each side plate.

83. Assembly of Synchronous Chart Drive Reroll Gear Train

(fig. 57)

a. Place the stop pawl (10) on the shaft in the top of the gear plate (4) with the bushing side next to the gear plate. Replace the lock ring (9).

b. Place the mounting plate assembly (11) face down on the workbench. Place the weighted pawl (8) in the hole next to the reroll clutch gear assembly (12) on the mounting plate assembly (11). The long bushing side should be facing up. The fork of the pawl should straddle the catch on the bottom of the reroll clutch gear assembly (12).

c. Place the driving gear (7) in the upper hole in the mounting plate assembly (11) with the pawl catch facing up.

d. Place the idler gear (6) in the center hole in the mounting plate assembly (11) with the large gear next to the mounting plate.

e. Place the clutch assembly (5) in the hole in the mounting plate assembly (11) next to the reroll clutch gear assembly (12).

f. Place the gear plate (4) over the gears with the gear shafts inserted in the matching holes. Turn the stop pawl (10) so that the fork straddles the pawl catch on the driving gear (7). Attach the gear plate (4) with the screws (3).

g. Replace the gear train cover (2) and attach with the screws (1).

h. Install the reroll assembly on the chart drive.

84. Assembly of Spring Chart Drive Reroll Gear Train

(fig. 58)

a. Place the mounting plate assembly (8) face down on the workbench. Place the weighted pawl (7) in the hole next to the reroll clutch gear assembly (9) on the mounting plate assembly (8). The long bushing side should be facing up. The fork of the pawl should straddle the catch on the bottom of the reroll clutch gear assembly.

b. Place the driving gear (6) in the upper mounting hole with the small gear side next to the mounting plate.

c. Place the idler gear (5) in the center mounting hole with the small gear side next to the mounting plate.

d. Place the gear plate (4) over the gears with the gear shafts inserted in the matching holes. Attach the gear plate (4) with the screws (3).

e. Replace the gear train cover (2) and attach with the screws (1).

f. Install the reroll gear train assembly on the chart drive.

85. Assembly of External Chart Drive

(fig. 59)

Note. During assembly, coat all gears, shafts, and bearings inside the motor and gear housing with grease (GL). Replace motor bearings with the grease seal facing the motor interior.

a. Insert the clutch assembly (68) with the gear toward the top, into the hole in the gear housing backplate (65). Place the clutch shaft knob (67) over the end of the clutch assembly shaft. Aline the holes and drive in the pin (66). The pin should protrude from the knob approximately one-sixteenth of an inch on each side.

b. Place the washers (62) on the screws (61). Insert the screw (61) through the hole in the top of the gear housing backplate (65). Replace the spacer nuts (64) on the screws. Tighten the nuts (64) that are closest to the gear housing backplate (65).

c. Replace the bearings (70) in the gear housing backplate (65) with a handpress. Place the washers (58) on the screws (57). Insert the screws (57) through the hole in the top of the gear housing backplate (65). Replace the large spacer nuts (60) and tighten. Place the gear housing backplate (65) on the mounting plate (69) with the screws (57 and 61) extending through the mounting holes. Replace the nuts (63 and 59). Tighten the lower spacer nuts (64) against the top of the mounting plate (69).

d. Insert the grommet (56) in the hole in the bottom side plate (55). Attach the bottom side plate (55) to the posts on the lower end of the gear housing backplate (65) with the screws (54).

e. Attach the binding post assembly (52) and the voltage plate (53) to the right-hand side plate (49) with the nut (50) and the lockwasher (51). Attach the right-hand side plate (49) to the posts on the right-hand end of the gear housing backplate (65) with the screws (48).

f. Attach the left-hand side plate (47) to the posts on the left-hand end of the gear housing backplate (65) with the screws (46).

g. Attach the top side plate (36) to the posts on the upper end of the gear housing backplate (65) with the screws (35).

h. Place the shaft knob (41) on the end of the worm gear shaft (43). Aline the holes and drive in the pin (40). The pin should protrude approximately one-sixteenth of an inch from each side of the shaft knob. Insert the free end of the worm gear shaft (43) through the hole in the bushing block (37). Place the shaft stop (44) over the end of the worm gear shaft (43). Place the worm gear (45) between the bushing block sides and slide the worm gear shaft (43) through the worm gear (45) and the hole in the opposite side of the bushing block (37). Aline the pinhole in the worm gear (45) with the hole in the worm gear shaft (43) and drive in the pin (42). The pin should be flush with both sides of the worm gear.

i. Place the drive shaft assembly (38) and the idler shaft assembly (39) into their bushings in the gear housing backplate (65) with the gear end up. Place the bushing block (37) over the ends of the drive shaft and idler shaft assemblies.

j. Coat the shaft knob (41) with grease (GL) and slide on the coupler (25).

k. Replace the grease fitting (31) in the top side plate (36) and secure with the locknut (30).

l. Slide the collar (29) onto the shaft of the motor (22) with the beveled edge out. Place the motor shaft knob (27) on the shaft of the motor (22), aline the pinholes, and drive in the pin (26). The pin should protrude approximately one-sixteenth of an inch from each side of the shaft knob. Turn the shaft collar (29) so that the setscrew (28) is over the flatted portion of the motor shaft. Hold the shaft collar (29) firmly against the motor shaft knob (27) and tighten the setscrew (28).

m. Coat the motor shaft knob (27) with grease (GL). Slide the shaft of the motor (22) through the hole in the bottom side plate (55) and into the coupler (25).

n. Place the rubber washers (20) over the screws (19) followed by the metal washers (21). Position the motor (22) over the mounting holes in the mounting plate (69) and replace the screws (19). Run the motor wiring through the cable clamps (24) and attach the cable clamps to the mounting plate (69) with the screws (23). Insert the motor wiring through the grommet (56). Solder the wiring connections (fig. 69) to the switch (34). Attach the wiring terminals to the binding post assembly (52) with the washers (18) and the nuts (17).

o. Insert the switch (34) through the hole in the top side plate (36). Place the switch plate (33) over the screw threads and screw on the knurled nut (32) until the outer surface of the nut is flush with the end of the switch threads. Tighten the locking nut

on the switch (34) tight against the back of the top side plate (36).

p. Press the bushing (16) into the hole in the cover plate (15) with a hand press. Replace the cover plate (15) with the corner screws (13) and the screws (14). Place the small drive gear (12) on the idler shaft assembly (39) with the slotted side of the bushing seated over the projections on the shaft. Place the washer (11) over the shaft followed by the lockwasher (10) and the washer (9). Screw on the knurled nut (8).

q. Place the large drive gear (7) on the drive shaft assembly (38) followed by the washer (6), lockwasher (5), and the washer (4). Screw on the knurled nut (3).

r. Place the gear cover (2) over the large and small gears (7 and 12) and attach with the screws (1).

86. Assembly of Recorder

(fig. 52)

a. Chart Drives. Reassemble the synchronous chart drives and the spring chart drives (pars. 81 and 82).

b. Wind Speed Recorder.

(1) Screw the shaft bushing nut (76) into the bottom of the case (61).

(2) Place the zero adjustment lever (75) on the bottom of the shaft (72) and attach with the lockwashers (74) and the bushing nut (73). Place the shaft (72) in the bottom of the meter element (33) with the lever pointing away from the mounting board.

(3) Place the rubber bumper (70) between the two holes in the bottom of the case cover (1). Insert the shaft (69) through the right-hand hole in the bottom of the case cover (1). Push it through the hole in the case cover, and tighten with a screwdriver.

(4) Insert the latch screw (68) in the top of the case cover (1) and screw on the nut (67). Coat the inside front of the case cover (1) with plastic cement for one-fourth of an inch around the window openings. Press the front window glass (65) into the cement and secure the glass with the clips (64) and the screws (63). Press the top window glass (66) into the cement and secure with the clips (64) and the screws (63). Clean off the excess cement.

(5) Attach the case (61) to the mounting chassis (62) with the four screws (59) and the lockwashers (60).

(6) Attach the carrying handle (54) to the top of the case (61) with the screws (51), the lockwashers (53), and the nuts (52). Place the lockwashers (58) on the screws (56). Insert the screws (56) from the inside of the case (61). Screw on the nuts (57) and the capnuts (55).

(7) Solder the wiring connections to the inserts of the connectors (49 and 50). Press the inserts in the connectors and replace the lock rings. Attach each connector to the terminal board (46) with the screws (47) and the lockwashers (48).

(8) Place the terminal board (46) inside the case (61) with the connector end down and attach with the screws (43), the lockwashers (45), and the nuts (44).

(9) Solder the wiring connections to the contact board (42). Place the contact board (42) on the inside of the case (61) and attach with the screws (40) and the lockwashers (41).

(10) Attach the mounting bracket (39) to the right-hand side of the meter element (33) with the screws (34) and the lockwashers (35). Place the relay bracket (36) on top of the mounting bracket (39). Place the relay (38) on top of the relay bracket (36) and replace the screws (37). Replace the the screw (9) and the washer (10) in the top of the relay bracket but do not tighten.

(11) Place the meter element (33) in the case (61) and attach with the screws (29), the screw (30), the lockwashers (32), and the nut (31). Solder the wiring connections to the meter element.

(12) Solder the wiring connections to the insert of connector (27). Bring the connector insert through the connector hole in the bottom of the terminal board (24). Push the insert into the back of the connector (27) and secure with the lock ring (28). Attach the connector (27) to the terminal board (24) with the screws (25) and the

lockwashers (26). Place the terminal board (24) inside the case (61) with the connector hole down and attach with the screws (21), the washers (23), and the nuts (22).

(13) Replace the nameplate (17) in the bottom of the case and attach with the front screws (16). Place the bracket (18) over the zero adjustment lever (74) and replace the remaining screws (16).

(14) Replace the cover hinges (15) and secure the hinges with the screws (14).

(15) Place the wind speed chart drive (13) into the case and tighten the corner screws (12). Slide the shaft coupler (11) over the chart drive shaft knob so that the pins in the shaft seat in the notches of the coupler.

Note. If the wind direction chart drive has been installed before the wind speed chart drive, place the shaft coupler (11) on the wind direction chart drive shaft knob before placing the wind speed chart drive (13) into the case.

(16) Replace the chrono pen (6) in the hole in the front of the relay bracket (36).

(17) Place the washer (4) on the screw (2), and insert the screw (2) up through the case (61). Place the cover latch (5) over the screw threads followed by the second washer (4) and screw on the capnut (3).

(18) Replace the inkwell (8). Close the case cover and swing the cover latch (5) to the left to secure the cover.

(19) Replace the gasket (71) on the inside edge of the case cover (1). Place the case cover (1) in the cover hinges (15).

(20) Replace the back panel (20) and attach with the screws (19).

c. Wind Direction Recorder. The procedure for reassembling the wind direction recorder is the same as outlined in *b* above except that the terminal board (46) has only one connector and that the screws (56), the lockwashers (58), the nuts (57), or the capnuts (55) are not used.

87. Assembly of Reducing Valve

(fig. 60)

a. Replace the glass in pressure gages M1 and M2 by placing the beveled edges of the glass out and screwing on the cap.

b. Coat the threads of the gage fittings with antiseize compound (GLP) and screw into the valve housing. Tighten securely with the gages facing the handle.

c. Coat the threads of tank fitting H1 with (GLP) and screw into the valve housing. Tighten securely with a small pipe wrench.

d. Coat the threads of hose fitting H2 with antiseize compound (GLP) and screw into the valve housing. Tighten securely.

e. Coat the threads of release valve H3 with antiseize compound (GLP) and screw into the valve housing. Tighten securely.

f. Screw in handle H4.

88. Testing and Selecting Critical Circuit Parts, Amplifier-power Supply

If resistor R18 or capacitor C5B, C6B, C6C, C7B, C7C, C8B, or C8C is suspected of being defective, use the following procedure to test the part, and to select a proper replacement.

Note. If regulator tube V4 is replaced, resistor R18 may have to be replaced. Perform the procedure given in *a* through *c* below.

a. Test Setup. Connect the amplifier-power supply, the wind speed recorder, and the test equipment as shown in figure 61.

b. Test Procedure.

(1) Turn on the power switch of each equipment, and allow 5 minutes warmup time.

(2) Adjust the output of the transformer to 105 volts. Monitor the output voltage of the transformer with the vacuum tube voltmeter.

(3) Adjust the audio oscillator for 20 volts at each frequency given below; observe and note the reading of the wind speed recorder for each indicated position of the MAX. RANGE MPH switch (amplifier-power supply).

Note. The voltage and frequency output of the audio oscillator must be kept constant. Monitor the output with the frequency meter and the vacuum tube voltmeter.

MAX. RANGE MPH switch position	Audio oscillator output (cps)	Wind speed recorder reading (mph)
60	1740.4	60 ±2.4
30	862.9	30 ±1.2
12	336.4	12 ± .48
6	160.9	6 ± .25

c. Selecting Resistor R18. If all the readings (*b* above) are off in the same direction and not within the specified limits, select and try a replacement resistor; use resistor type RC30GF, G, H, I, J, or K (fig. 65) until the specified limits are obtained.

(1) Replace resistor R18 with one of a lower value if the wind speed recorder readings are too high.

(2) Replace resistor R18 with one of a higher value if the wind speed recorder readings are too low.

d. Selecting Capacitor C5B. If the reading is not within the specified limits with the MAX. RANGE MPH switch on the 60 position (*b* above), proceed as follows:

(1) Check capacitor C5A and replace if defective.

(2) Replace capacitor C5B (use capacitor type CM20C, D, E, F, G, H, I, or J) by the cut and try method until the wind speed recorder reading falls within the specified limits (60 ±2.4 mph).

e. Selecting Capacitor C6B or C6C. If the reading is not within the specified limits with the MAX. RANGE MPH switch on the 30 position (*b* above), proceed as follows:

(1) Check capacitor C6A and replace if defective.

(2) Replace capacitor C6B or C6C (use capacitor type CM25C, D, E, F, G, H, I, J, or K) by the cut and try method until the wind speed recorder reading falls within the specified limits (30 ±1.2 mph). If necessary, replace C6B and C6C to obtain the proper reading.

f. Selecting Capacitor C7B or C7C. If the reading is not within the specified limits with the MAX. RANGE MPH switch on the 12 position (*b* above), proceed as follows:

(1) Check capacitor C7A and replace if defective.

(2) Replace capacitor C7B (use capacitor type CM35C, D, E, F, G, H, I, J, or K) or C7C (use capacitor type CM25C, D, E, F, G, H, I, J, or K) by the cut and try method until the wind speed recorder reading falls within the specified limits (12 ±.48 mph). If necessary, replace C7B and C7C to obtain the proper reading.

g. Selecting Capacitor C8B or C8C. If the reading is not within the specified limits with the MAX. RANGE MPH switch on the 6 position (*b* above), proceed as follows:

(1) Check capacitor C8A and replace if defective.

(2) Replace capacitor C8B (use capacitor type CM25C, D, E, F, G, H, I, J, orK) or C8C use capacitor type CM20C, D, E, F, G, H, I, or J) by the cut and try method until the wind speed recorder reading falls within the specified limits (6 ±.25 mph). If necessary, replace C8B and C8C to obtain the proper reading.

89. Testing and Selecting Critical Circuit Parts Wind Speed Detector

The accuracy of the wind speed circuit depends upon the output of phototube V201 and exciter lamp DS201 in the wind speed detector. The following test should be performed whenever inaccurate wind speed recorder readings are obtained (par. 46*a*).

a. Test Setup. Connect the amplifier-power supply, the wind speed recorder, the wind speed detector, and the test equipment as shown in figure 62.

b. Test Procedures.

(1) Turn on the power switch of each equipment, and allow 5 minutes warmup time.

(2) Adjust the output of the transformer to 105 volts. Monitor the output voltage of the transformer with the vacuum tube voltmeter.

(3) Set the MAX. RANGE MPH switch (amplifier-power supply) to the 6 position.

(4) Turn on the chart drive of the wind speed recorder and carefully hand rotate the anemometer to produce a full scale deflection on the wind speed recorder.

(5) Check to see that the wind speed recorder produces a reading of 38 volts peak-to-peak on the oscilloscope for a full scale deflection.

c. Replacing Exciter Lamp and/or Phototube. If the oscilloscope reading of 38 volts peak-to-peak is not obtained, replace phototube V201, or exciter lamp DS201 (par. 6) to obtain the proper reading. If necessary, replace the exciter lamp *and* the phototube to obtain the proper reading.

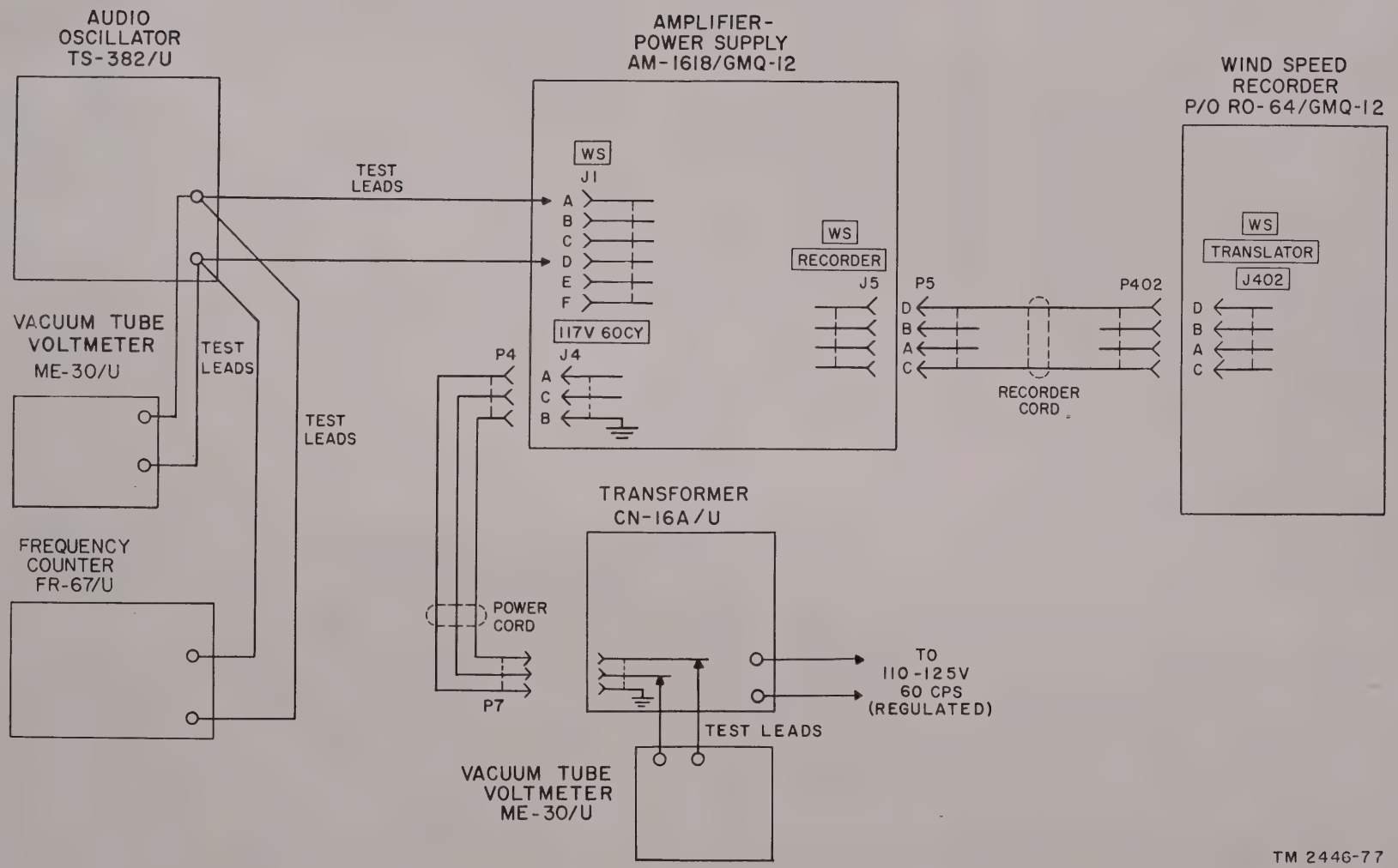


Figure 61. Test setup for selecting critical circuit parts in the amplifier-power supply.

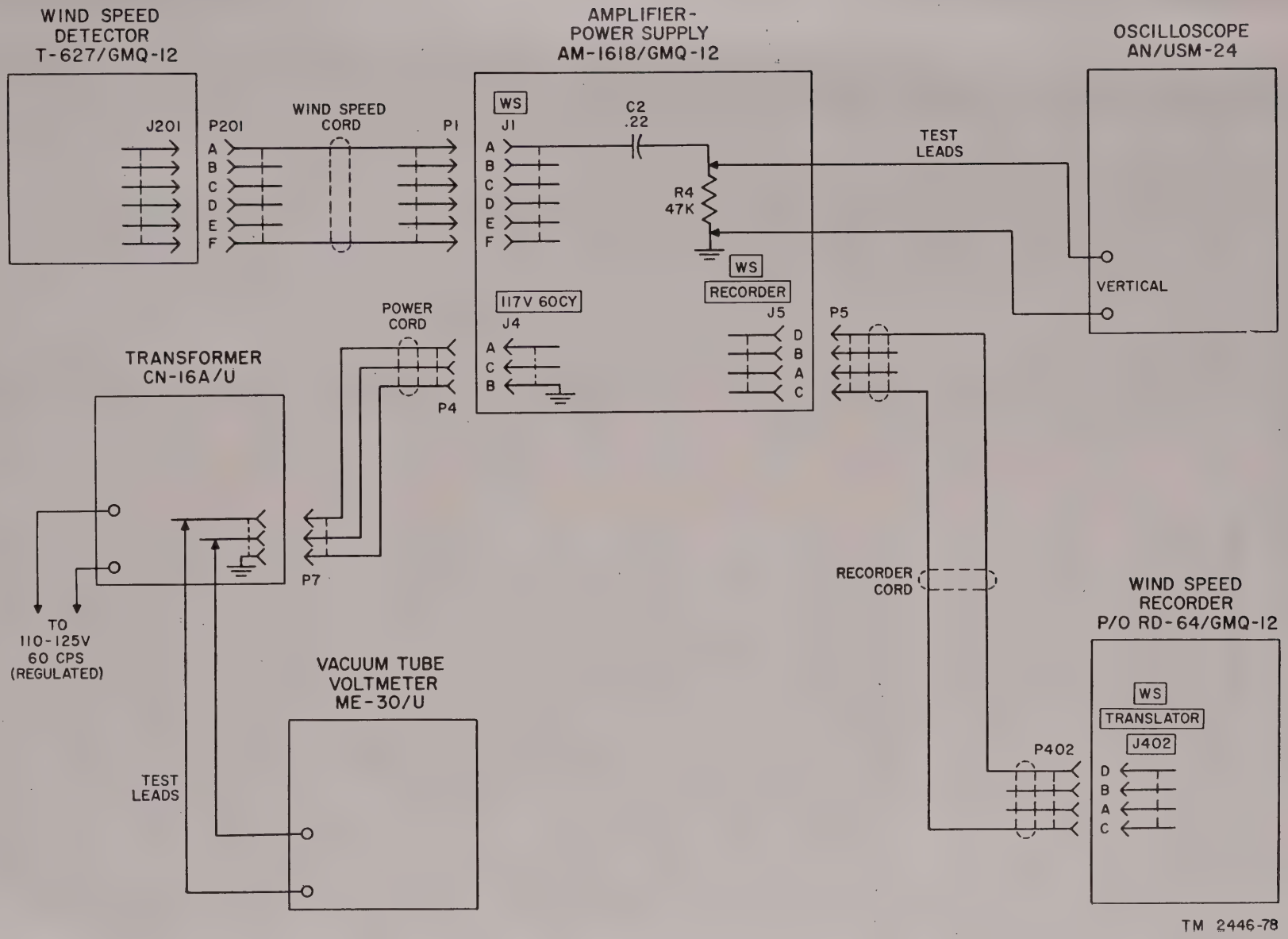


Figure 62. Test setup for selecting critical circuit parts in wind speed detector.

Section IV. ADJUSTMENTS AND FINAL TESTS

90. Test Equipment and Materials Required

In addition to the test equipment listed in paragraph 64, the following test equipment and materials are required for adjusting and final testing Wind Measuring Set AN/GMQ–12.

Item	Technical manual
Multimeter TS–352/U	TM 11–5527
2 flashlight batteries, 1.5 volt, size D	
Variable resistor, wire-wound, 5,000 ohms (Signal stock No. 3RP8706).	

91. Adjustment of Wind Direction Detector

a. Preparation for Adjustment.

(1) Obtain two pieces of plastic 6 inches square and at least one-fourth of an inch thick.

(2) Scribe two centerlines at right angles to each other on each piece of plastic.

(3) On one piece of plastic, mark one of the centerlines 0, then starting with the first line to the left of the line marked 0, mark the other lines 90°, 180°, and 270°, respectively.

(4) Drill a .656-inch diameter hole in the exact center of the piece of plastic marked in degrees.

(5) On the second piece of plastic, scribe several vertical lines ¼-inch apart on each side of the original vertical line. Keep the lines perfectly square with the edge of the plastic.

(6) Drill a .469-inch diameter hole in this piece of plastic.

Note. The piece of plastic marked in degrees is used for alinement of the rotating head, and the piece of plastic with the vertical lines is used for alinement of the sighting bar.

b. Adjustment of Variable Resistor R301.

(1) Remove the housing from the wind direction detector (par. 70).

(2) Line up the engraved mark on the lower edge of the rotating head (fig. 10) with the engraved mark on the top of the drive shaft housing.

(3) Carefully aline the marks and tape the rotating head to the drive shaft housing with masking or friction tape.

(4) Slightly loosen the locking nut (30, fig. 51) on the top of the bushing (31) of variable resistor R301 (32) so that the resistor may be turned with the fingers.

(5) Remove the amplifier-power supply chassis from its case.

(6) Connect the wind direction detector to the amplifier-power supply with the wind direction cord (fig. 16).

(7) Press forward W.D. ZERO ADJUST switch (fig. 11) on the top of the amplifier-power supply chassis and adjust the zero adjustment in the wind direction recorder (par. 20*c*) for a zero pen deflection (pen element rests on the extreme left-hand chart line). Release the W.D. ZERO ADJUST switch.

(8) Slowly rotate variable resistor R301 in the wind direction detector. *Do not* allow the rotating head on the drive shaft to turn until the pen element in the wind direction recorder rests exactly on the centerline of the chart. Be careful not to move the resistor from the centerline position; tighten the locking nut on the resistor.

(9) Adjust the wind direction recorder for full scale (par. 20*c*).

c. Adjustment of the Rotating Head.

(1) Remove the tape from the rotating head of the wind direction detector.

(2) Place the piece of plastic with the lines marked in degrees carefully over the rotating head and onto the drive shaft housing.

(3) Aline the zero line on the plastic exactly with the engraved mark on the drive shaft housing.

(4) Turn the rotating head so that the engraved mark lines up with the 180° line on the piece of plastic.

(5) Observe that the pen element in the wind direction recorder is resting on the extreme left- or right-hand chart line.

(6) Turn the rotating head in the extreme opposite position. Observe that the pen element in the wind direction recorder travels to the opposite extreme line on the chart.

(7) Turn the rotating head so that the en-

graved mark on the head lines up exactly with the 90° line on the piece of plastic. Observe that the pen element in the recorder has moved half way between the ecnter line and the left- or right-hand chart line.

(8) Turn the rotating head so that the engraved mark on the head lines up exactly with the 0 line on the piece of plastic. Observe that the pen element in the recorder has moved to the center line reference.

(9) Turn the rotating head so that the engraved mark on the head lines up exactly with the 270° line on the piece of plastic. Observe that the pen element in the recorder has moved half way between the center line and the left- or right-hand chart line (opposite the position obtained in (7) above).

Note. If tolerances more than ±5° are observed, replace variable resistor R301 (par. 70) and repeat (1) through (9) above.

d. Adjustment of the Sighting Bar.

(1) Disconnect the wind direction cord and remove the wind direction detector (fig. 10) from the crossarm.

(2) Place the piece of plastic marked in degrees over the rotating head and onto the drive shaft housing.

(3) Place the second piece of plastic with the scribed lines over the end of the tubular rod and against the sighting bar. Loosen the setscrew in the sighting bar.

(4) Using the pieces of plastic as supports, place the wind direction detector on a perfectly level surface.

(5) Turn the piece of plastic marked in degrees so that the zero line is vertical to the level surface.

(6) Turn the other piece of plastic so that the scribed lines are vertical to the level surface.

(7) Turn the wind direction detector so that the engraved mark on the top of the drive shaft housing lines up exactly with the zero line on the piece of plastic.

(8) Hold the wind direction detector firmly and turn the sighting bar collar (not shown) until the sighting bar lines up exactly parallel to the scribed lines on the piece of plastic. The pointer of the sighting bar will be pointing in the opposite direction to the connector in the bottom of the wind direction detector housing. Make sure that the engraved mark on the drive shaft housing still lines up with the zero line on the piece of plastic and tighten the setscrew in the sighting bar securely.

Note. Save the two pieces of plastic for use in future adjustments.

92. Final Test of Recorder Meter Elements

a. Remove the covers and manually adjust the zero adjustment controls of the wind speed and the wind direction recorders (fig. 15) for zero.

b. Check the meter element in each recorder as follows:

(1) Connect two 1.5-volt size D flashlight batteries in parallel.

(2) Connect the negative side of the flashlight batteries to pin B of connector J402 (fig. 65) on the back of the recorder. Connect the positive side of the batteries to the arm of the 5,000-ohm wire-wound variable resistor.

(3) Set Multimeter TS–352/U on the 2.5-milliampere range.

(4) Connect the negative lead from the multimeter to pin A of connector J402 on the back of the recorder. Connect the positive lead from the multimeter to one end of the variable resistor.

(5) Adjust the 5,000-ohm variable resistor until the multimeter reads 1 miliampere. If meter M401 deviates from full scale more than ±1%, replace the meter element.

(6) Disconnect the leads from terminals A and B of J402 and connect them to terminals A and B of connector J502. Perform the same test for meter M501, and replace it if necessary.

93. Final Test on Ampilfier-power Supply

a. Wind Speed Circuit. Follow the procedure given in paragraph 88*a* and *b*.

b. Wind Detection Circuit. Follow the procedure given in paragraph 20*c*.

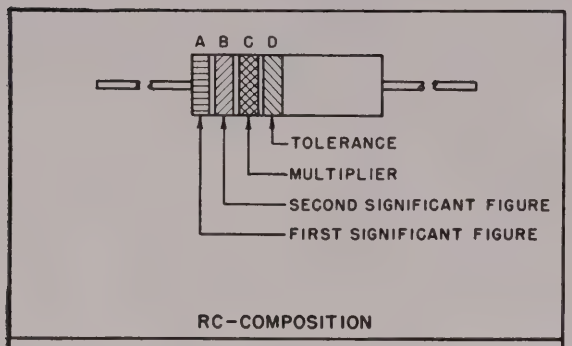
94. Final Test for Detectors

a. Wind Speed Detector. Gently blow on the anemometer to be sure it rotates freely.

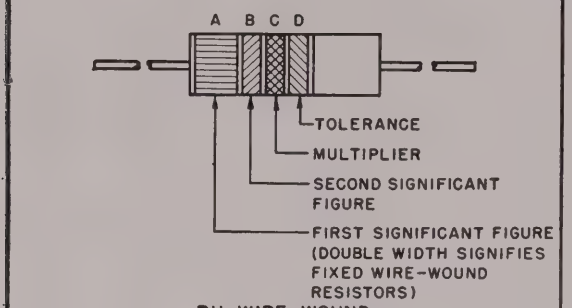
b. Wind Direction Detector. Gently tap the wind vane to be sure it rotates freely.

RESISTOR COLOR CODE MARKING
(MIL-STD RESISTORS)

AXIAL-LEAD RESISTORS (INSULATED)

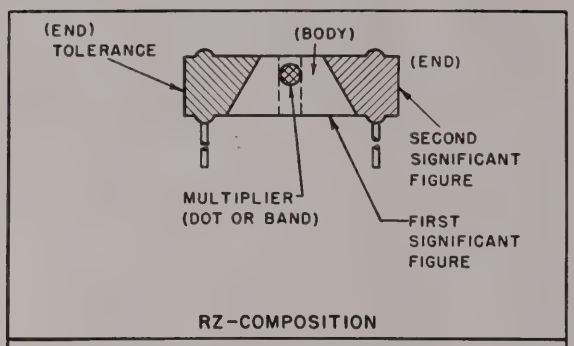


RC-COMPOSITION

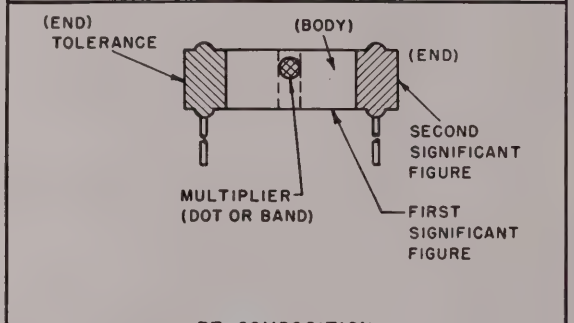


RU-WIRE-WOUND

RADIAL-LEAD RESISTORS (UNINSULATED)



RZ-COMPOSITION



RZ-COMPOSITION

RESISTOR COLOR CODE

BAND A OR BODY*		BAND B OR END*		BAND C OR DOT OR BAND*		BAND D OR END*	
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)
BLACK	0	BLACK	0	BLACK	1	BODY	± 20
BROWN	1	BROWN	1	BROWN	10	SILVER	± 10
RED	2	RED	2	RED	100	GOLD	± 5
ORANGE	3	ORANGE	3	ORANGE	1,000		
YELLOW	4	YELLOW	4	YELLOW	10,000		
GREEN	5	GREEN	5	GREEN	100,000		
BLUE	6	BLUE	6	BLUE	1,000,000		
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7				
GRAY	8	GRAY	8	GOLD	0.1		
WHITE	9	WHITE	9	SILVER	0.01		

*FOR WIRE-WOUND-TYPE RESISTORS, BAND A SHALL BE DOUBLE-WIDTH. WHEN BODY COLOR IS THE SAME AS THE DOT (OR BAND) OR END COLOR, THE COLORS ARE DIFFERENTIATED BY SHADE, GLOSS, OR OTHER MEANS.

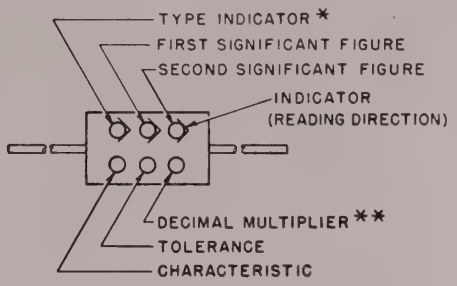
EXAMPLES (BAND MARKING):
10 OHMS ±20 PERCENT: BROWN BAND A; BLACK BAND B; BLACK BAND C; NO BAND D.
4.7 OHMS ±5 PERCENT: YELLOW BAND A; PURPLE BAND B; GOLD BAND C; GOLD BAND D.

EXAMPLES (BODY MARKING):
10 OHMS ±20 PERCENT: BROWN BODY; BLACK END; BLACK DOT OR BAND; BODY COLOR ON TOLERANCE END.
3,000 OHMS ±10 PERCENT: ORANGE BODY; BLACK END; RED DOT OR BAND; SILVER END.

STD-RI

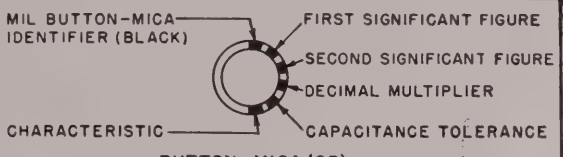
Figure 63. MIL-STD resistor color codes.

CAPACITOR COLOR CODE MARKING
(MIL-STD CAPACITORS)

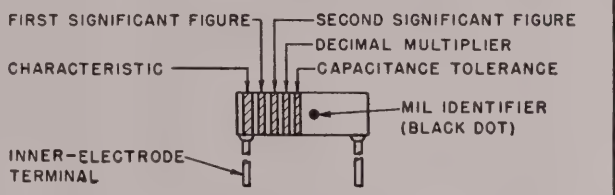


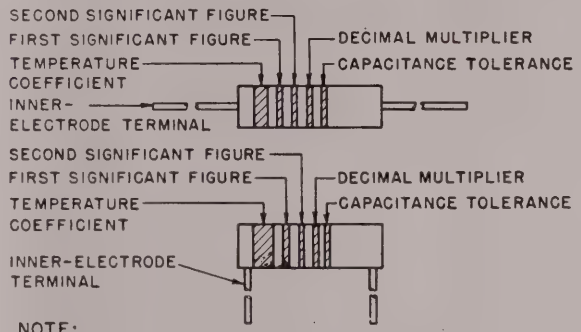
* BLACK DOT: MICA DIELECTRIC
SILVER DOT: PAPER DIELECTRIC
**INDICATES NUMBER OF ZEROS ON PAPER TYPE.

MICA (CM) AND PAPER (CN)



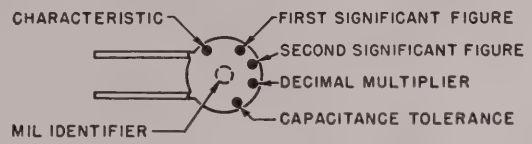
BUTTON-MICA (CB)





NOTE:
SPOTS MAY BE USED INSTEAD OF BANDS; TEMPERATURE COEFFICIENT MARKING IS LARGER.

CERAMIC-TEMPERATURE COMPENSATING (CC)



NOTES:
1. SPOTS MAY BE USED ON TUBULAR CAPACITORS; CHARACTERISTIC SPOT IS LARGER AND MIL IDENTIFIER IS ON SIDE DIAMETRICALLY OPPOSITE COLOR SPOTS.
2. MIL IDENTIFIER OF DISK TYPE IS ON REVERSE SIDE; CHARACTERISTIC SPOT IS LARGER OR SPACE BETWEEN CHARACTERISTIC AND TOLERANCE SPOTS IS THREE TIMES SPACE BETWEEN ADJACENT SPOTS.
3. TOLERANCE: YELLOW, +100%, −20%.

CERAMIC-GENERAL PURPOSE (CK)

CAPACITOR COLOR CODE

COLOR	SIG FIG.	MULTIPLIER		CHARACTERISTIC[1]				TOLERANCE[2]					TEMPERATURE COEFFICIENT (UUF/UF/°C)
		DECIMAL	NUMBER OF ZEROS	CM	CN	CB	CK	CM	CN	CB	CC		
											OVER 10UUF	10UUF OR LESS	CC
BLACK	0	1	NONE		A			20	20	20	20	2	ZERO
BROWN	1	10	1	B	E	B	W				1		−30
RED	2	100	2	C	H		X	2		2	2		−80
ORANGE	3	1,000	3	D	J	D			30				−150
YELLOW	4	10,000	4	E	P								−220
GREEN	5		5	F	R						5	0.5	−330
BLUE	6		6		S								−470
PURPLE (VIOLET)	7		7		T	W							−750
GRAY	8		8			X						0.25	+30
WHITE	9		9								10	1	−330(±500)[3]
GOLD		0.1						5		5			+100
SILVER		0.01						10	10	10			

1. LETTERS ARE IN TYPE DESIGNATIONS GIVEN IN MIL-C SPECIFICATIONS.
2. IN PERCENT, EXCEPT IN UUF FOR CC-TYPE CAPACITORS OF 10 UUF OR LESS.
3. INTENDED FOR USE IN CIRCUITS NOT REQUIRING COMPENSATION.

STD-CI

Figure 64. MIL-STD capacitor color codes.

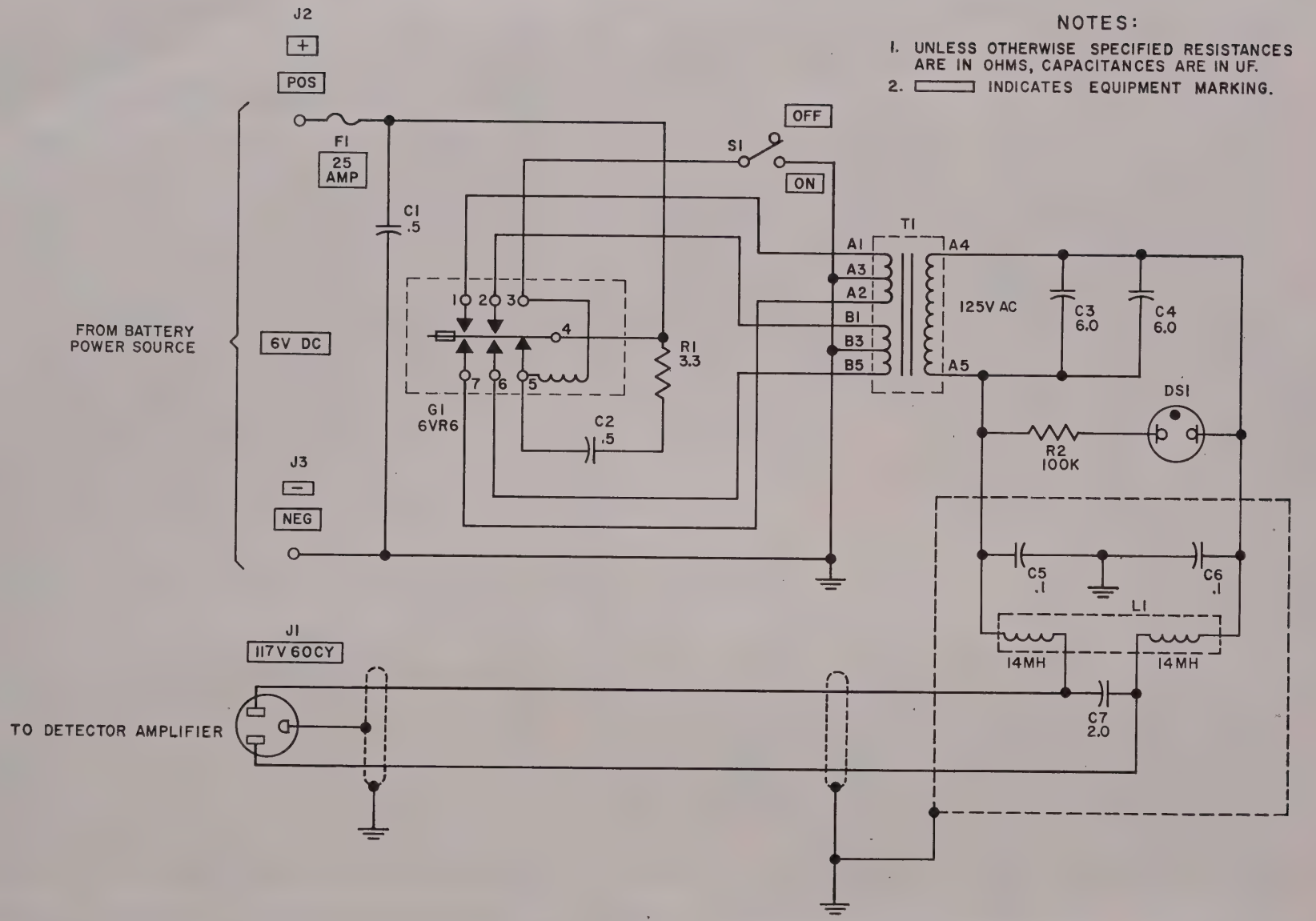
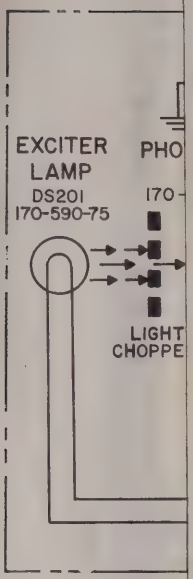


Figure 66. Vibrator inverter, schematic diagram.



1. UNLESS OTHE
   RESISTANCES
   CAPACITANCES
2. ☐ IN
3. WAFER SWITC
   MAX.-RANGE-N
   ARE IN POSITI
   THE SEGMENTS
   END OPPOSITE
4. WAFER SWITC
   CABLE IMPEDA
   ARE IN POSITI
   THE SEGMENT
   END OPPOSITE
5. SWITCHES S3
6. EXTERNAL SW
7. RECORDER PO

* CAPACITOR OR

J2

J5

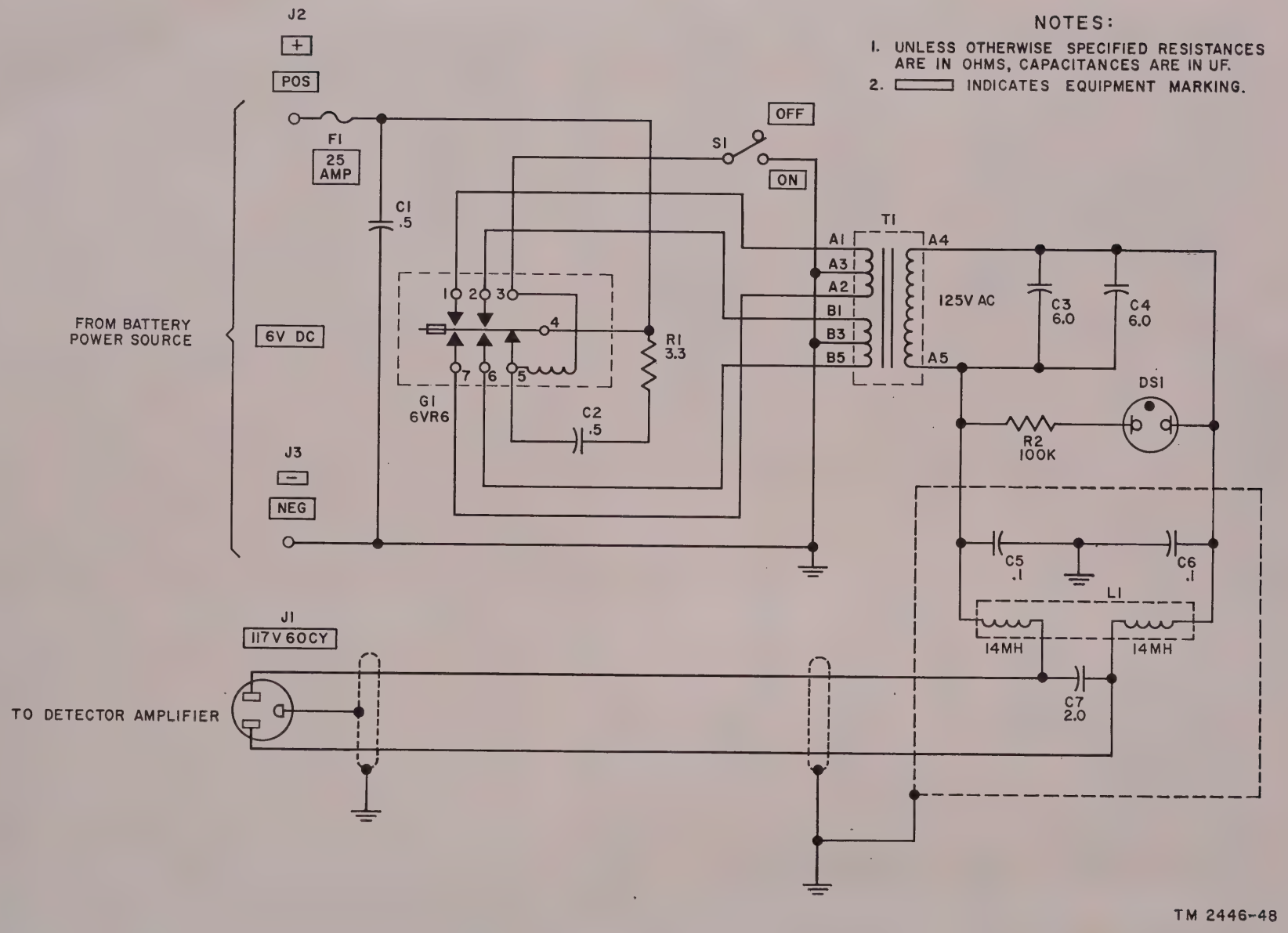


Figure 66. Vibrator inverter, schematic diagram.

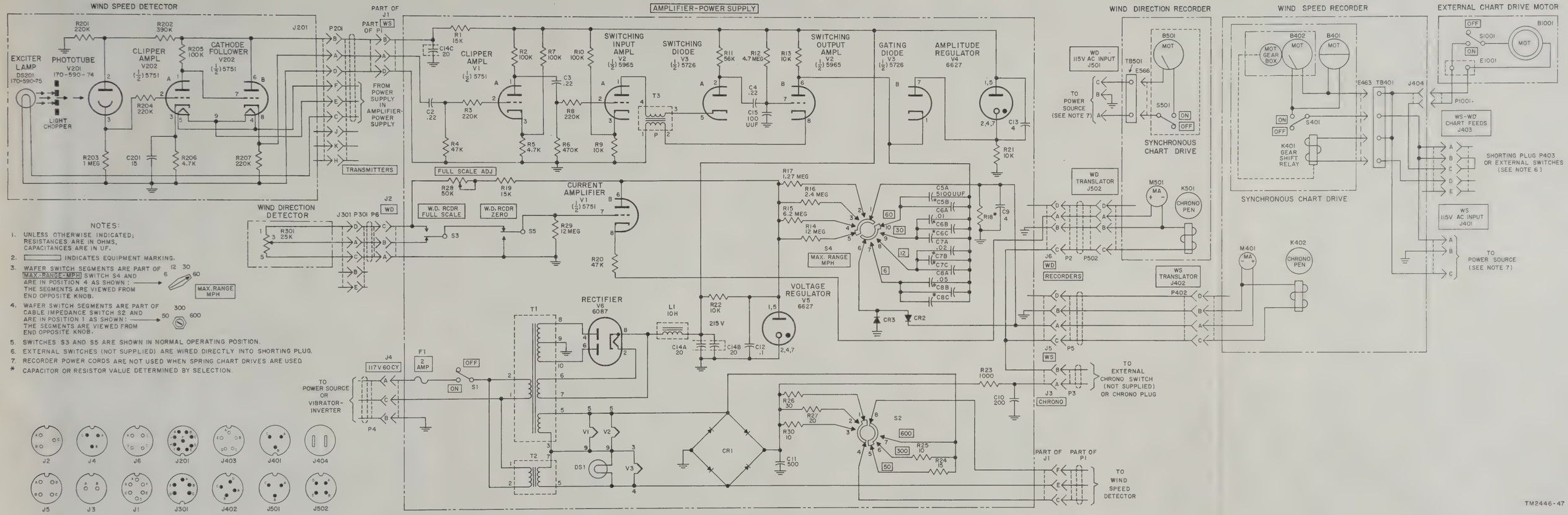
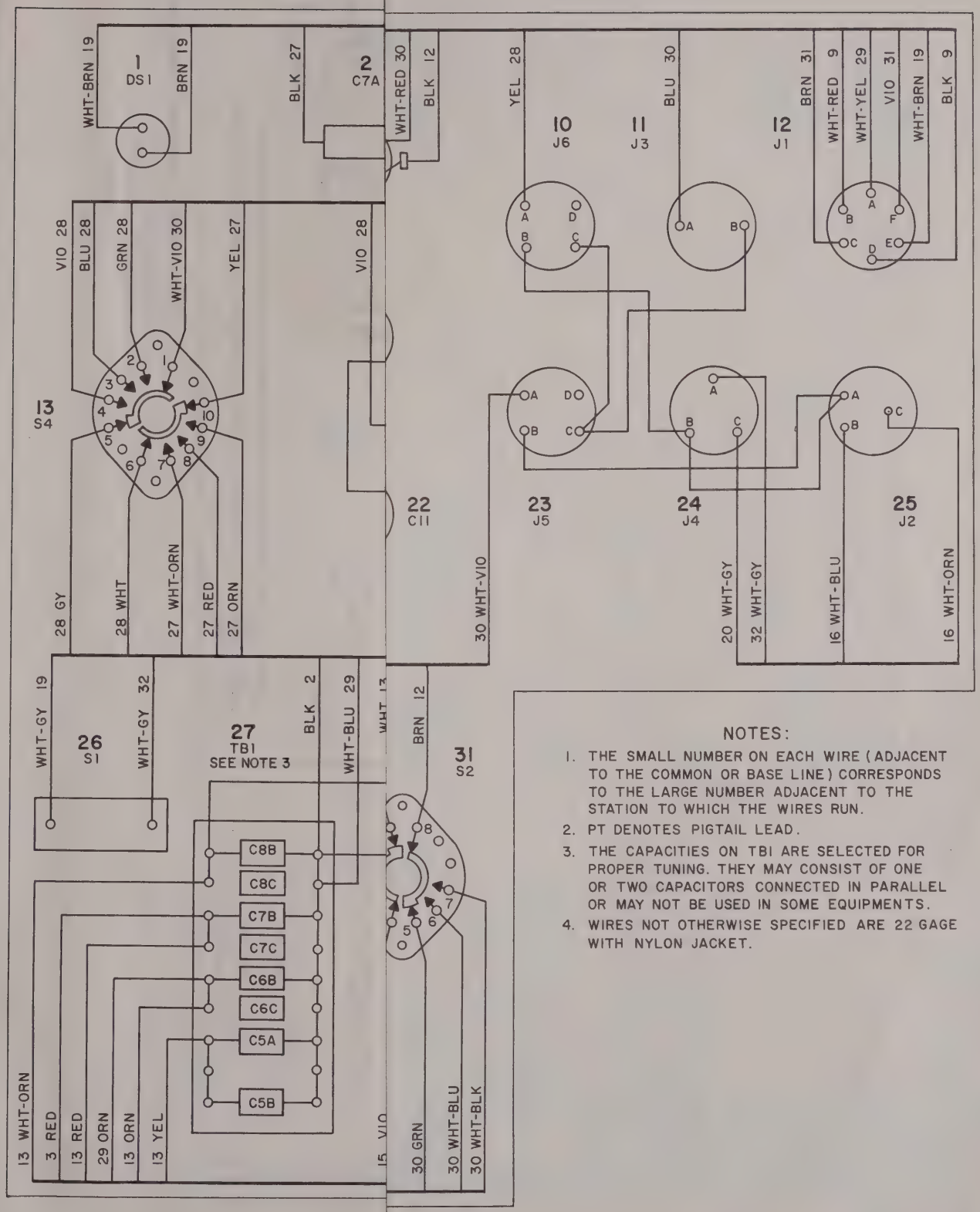


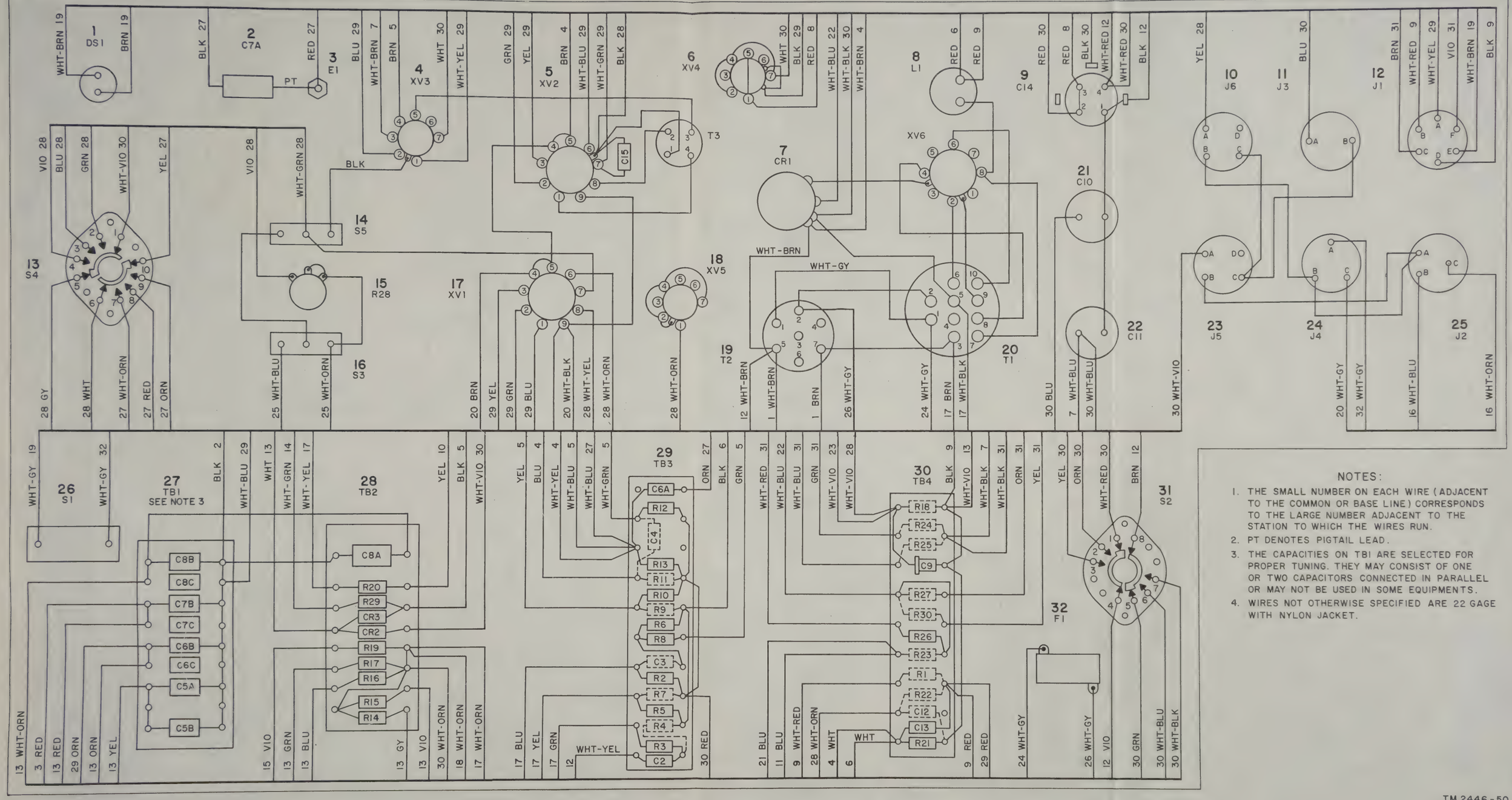
Figure 65. Amplifier-power supply, recorders, and wind speed and wind direction detectors, schematic diagram.



NOTES:

1. THE SMALL NUMBER ON EACH WIRE (ADJACENT TO THE COMMON OR BASE LINE) CORRESPONDS TO THE LARGE NUMBER ADJACENT TO THE STATION TO WHICH THE WIRES RUN.
2. PT DENOTES PIGTAIL LEAD.
3. THE CAPACITIES ON TB1 ARE SELECTED FOR PROPER TUNING. THEY MAY CONSIST OF ONE OR TWO CAPACITORS CONNECTED IN PARALLEL OR MAY NOT BE USED IN SOME EQUIPMENTS.
4. WIRES NOT OTHERWISE SPECIFIED ARE 22 GAGE WITH NYLON JACKET.

TM 2446-50



NOTES:

1. THE SMALL NUMBER ON EACH WIRE (ADJACENT TO THE COMMON OR BASE LINE) CORRESPONDS TO THE LARGE NUMBER ADJACENT TO THE STATION TO WHICH THE WIRES RUN.
2. PT DENOTES PIGTAIL LEAD.
3. THE CAPACITIES ON TB1 ARE SELECTED FOR PROPER TUNING. THEY MAY CONSIST OF ONE OR TWO CAPACITORS CONNECTED IN PARALLEL OR MAY NOT BE USED IN SOME EQUIPMENTS.
4. WIRES NOT OTHERWISE SPECIFIED ARE 22 GAGE WITH NYLON JACKET.

Figure 67. Amplifier-power supply, wiring diagram.

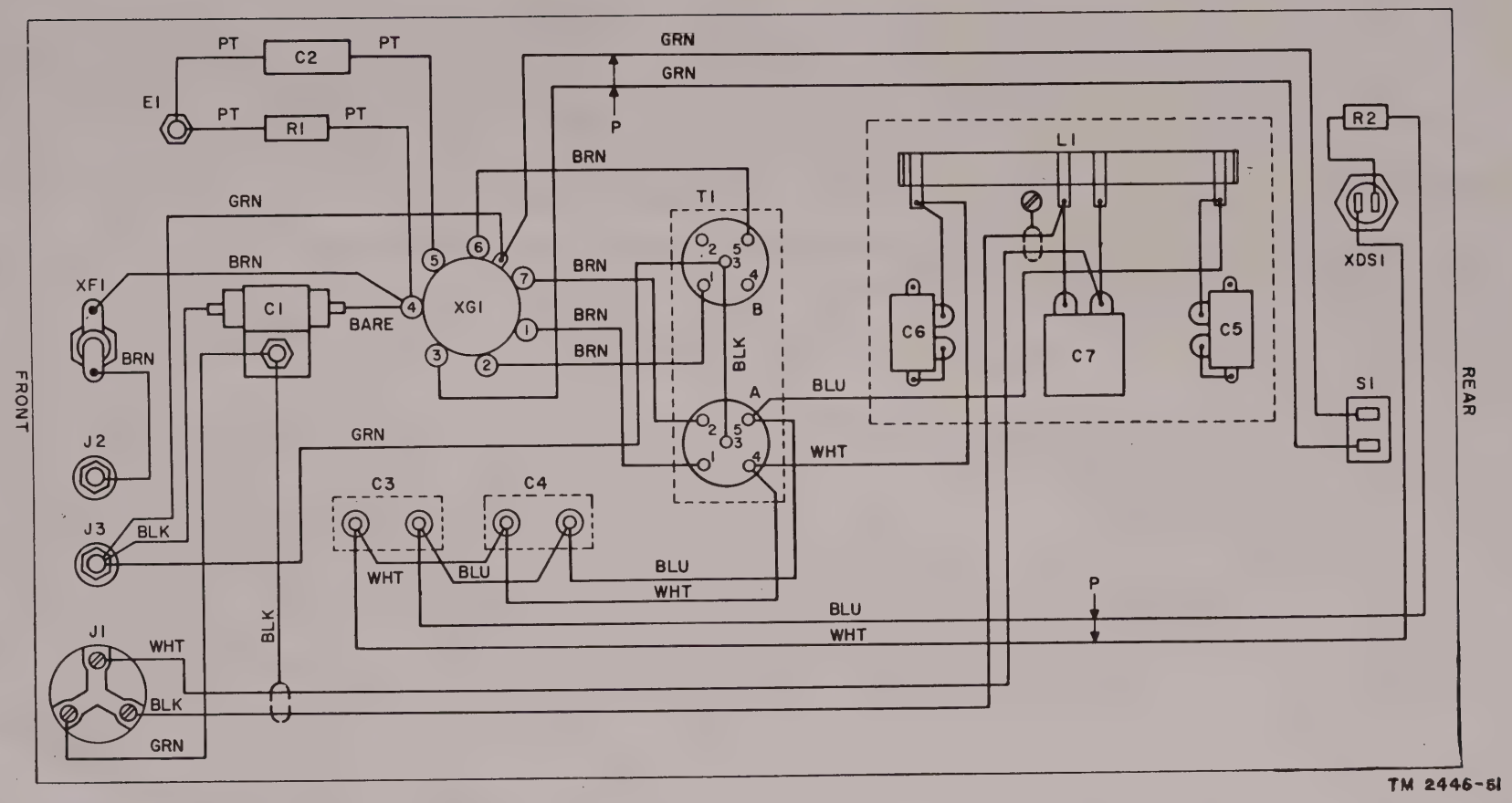


Figure 68. Vibrator-inverter, wiring diagram.

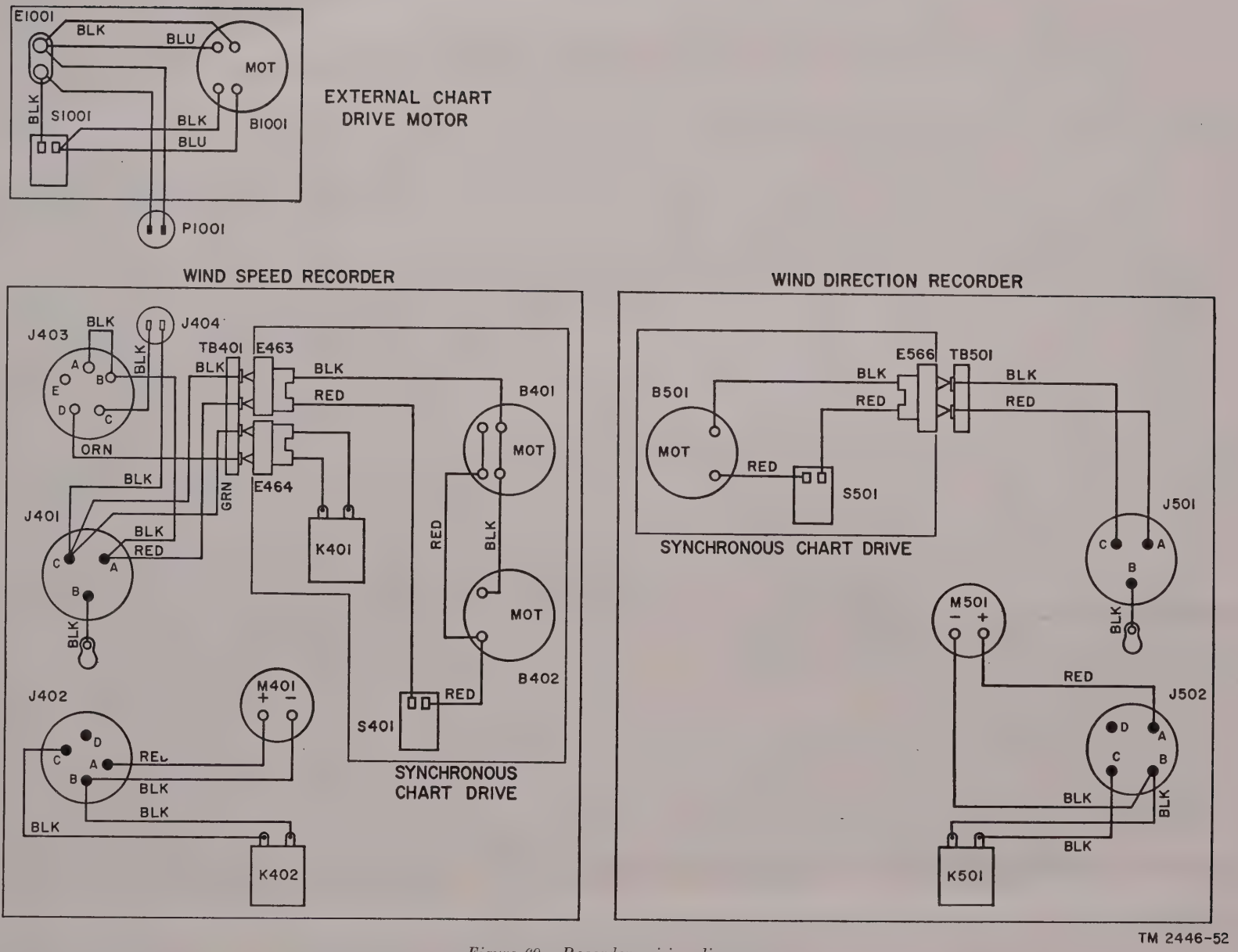


Figure 69. Recorder, wiring diagram.

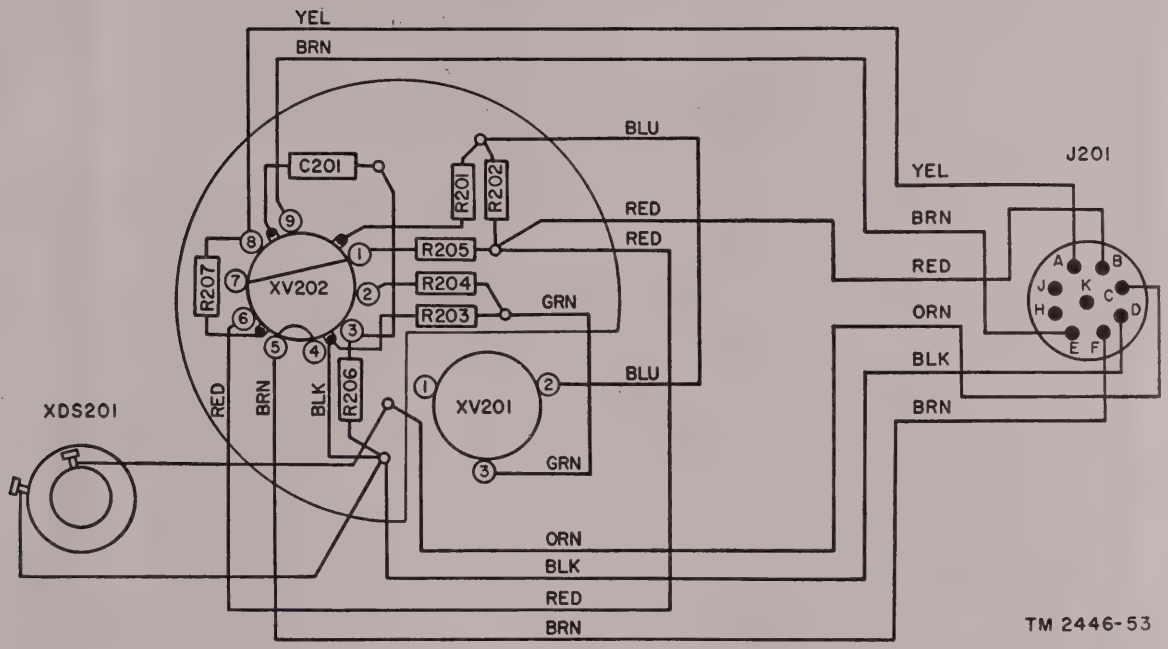


Figure 70. Wind speed detector, wiring diagram.

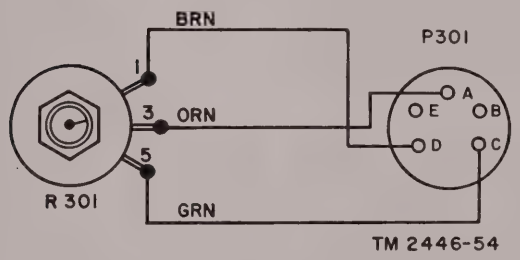


Figure 71. Wind direction detector, wiring diagram.

CHAPTER 7

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

95. Disassembly for Repairing

a. Disassembly of Wind Measuring Set.

(1) Disconnect all cords and roll them up.

(2) Turn off the valve on top of the nitrogen tank. Disconnect the hose assembly from the wind speed and wind direction detectors and the reducing valve. Remove the reducing valve from the nitrogen tank, and roll up the hose assembly. Be very careful not to let any dirt or moisture enter the hose assembly.

(3) Disassemble the wind speed and wind direction detectors and the tripod by reversing the assembly instructions given in paragraphs 14 and 15.

Caution: Handle the wind speed and the wind direction detectors carefully. Even a slight bump may seriously damage the bearings in the rotating heads. Be careful not to let any dirt get in the rotating heads.

(4) Replace the guard cap on the nitrogen tank.

b. Packing Equipment in Carrying Cases. Refer to figure 3 and pack the equipment in the carrying cases as follows:

(1) Place the crossarm and tripod in carrying case No. 1. Roll up the three guy wires, place them in the cover of carrying case No. 1 and secure with the leather catches. Close the cover of carrying case No. 1 and snap the latches closed.

(2) Place the vibrator and running spares for the vibrator in carrying case No. 2. Close the cover of carrying case No. 2 and snap the latches closed.

(3) Place the running spares for the amplifier-power supply, all connecting cords, and the hose assembly in carrying case No. 3. Place the amplifier-power supply wind speed detector, wind direction detector and the reducing valve in carrying case No. 3. Close the cover of carrying case No. 3 and snap the latches closed.

(4) Attach the spring chart drives and the external chart drive motor of the mounting board and slide the mounting board into carrying case No. 4. Remove the two inkwells, pen elements and chronograph pens from the recorder. Empty the inkwells and the chronograph pen inkwells and clean them thoroughly. Clean the pens thoroughly. Replace the inkwells, pen elements and chronograph pens in the recorder. If the pen holder card was saved during assembly, attach each pen element to a pen holder card. Slide each pen holder card into the top of the recorder over the top of the inkwell and chart feed roller. Place the recorder and accessory kit in the carrying case No. 4. Pack around the recorder with corrugated padding. Place the shorting plug and external chart drive motor coupler in the bracket in the front of carrying case No. 4 and snap the leather catch in place. Close the cover of carrying case No. 4 and snap the latches closed.

96. Repacking for Shipment or Limited Storage

Repack the equipment, if possible, according to the original packing procedures (figs. 5 and 6). Follow the instructions below.

a. Carrying Cases No. 1, No. 2, and No. 3 (fig. 5). Carrying cases No. 1, 2, and 3 are packaged as follows:

(1) Place the carrying case in the waterproof corrugated box.

(2) Place padding on the front, back, and both ends of the carrying case.

(3) Close the waterproof corrugated box and seal with waterproof tape.

(4) Place the waterproof corrugated box in the wooden crate.

(5) Package the literature by placing it in a waterproof envelope. Place the envelope containing the literature on top of the waterproof corrugated box in wooden crate No. 1 only.

(6) Nail on the wooden cover.

(7) Further secure the wooden crate by nailing on metal straps.

b. Carrying Case No. 4 (fig. 6). Carrying case No. 4 is packaged as follows:

(1) Place the carrying case in the inner corrugated box. Place padding on the top, front, back, and both ends of the carrying case.

(2) Place the inner corrugated box in the waterproof corrugated box.

(3) Close and seal the waterproof corrugated box with waterproof tape.

(4) Place a sheet of corrugated padding in the bottom of the wooden crate.

(5) Place the waterproof corrugated box in the wooden crate and place padding snugly on the front, back, both ends and on the top of the waterproof corrugated box.

(6) Nail on the wooden cover.

(7) Further secure the wooden crate by nailing on metal straps.

Note. For information regarding the approximate size and contents of the wooden shipping containers, refer to paragraph 10.

Section II. DEMOLITION OF MATERIAL TO PREVENT ENEMY USE

97. Authority for Demolition

Demolition of the equipment will be accomplished only upon order of the commander. The demolition procedures outlined in paragraph 98 will be used to prevent the enemy from using or salvaging the equipment.

98. Methods of Destruction

a. Smash. Smash the wind speed and wind direction detectors, the amplifier-power supply, the vibrator-inverter, the recorders, and all component parts; use axes, sledges, handaxes, pickaxes, hammers, crowbars, or other heavy tools.

b. Cut. Cut all cables and connections; use axes, handaxes, or machetes.

c. Burn. Burn cords and technical manuals; use gasoline, kerosene, oil, flamethrowers, or incendiary grenades.

d. Explosives. If explosives are necessary, use firearms, grenades or TNT.

e. Disposal. Bury or scatter the destroyed parts in slit trenches, foxholes, or throw into streams.

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By Order of *Wilber M. Brucker,* Secretary of the Army:

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NG: State AG; units—same as Active Army.

USAR: None.

For explanation of abbreviations used, see SR 320–50–1.

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